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ON

JOINT-DISEASES;

THEIR PATHOLOGY, DIAGNOSIS, AND TREATMENT:

INCLUDING THE NATURE AND TREATMENT OF DEFORMITIES,
AND CURVATURES OF THE SPINE.

BY HOLMES COOTE, F.R.C.S.,

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TO

WILLIAM LAWRENCE, F.R.S.,

Serjeant Surgeon to the Queen,

CONSULTING SURGEON TO ST. BARTHOLOMEW'S HOSPITAL, &c., &c.,

WHOSE BRILLIANT TALENTS,

UNSURPASSED ENERGY OF CHARACTER, AND VAST PROFESSIONAL KNOWLEDGE,

HAVE CONTRIBUTED LARGELY TO MAINTAIN

THE HIGH REPUTE OF THE HOSPITAL OF WHICH HE HAS BEEN

SO LONG AN ORNAMENT,

THESE PAGES ARE INSCRIBED WITH EVERY FEELING OF RESPECT AND GRATITUDE,

BY HIS FORMER PUPIL,

THE AUTHOR.

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B. M. J.

PREFACE.

THE improvements which have been effected in medical and surgical practice by the labours of those who, during the last twenty years, have cultivated the broad field of pathological anatomy, can in no way be better illustrated than by contrasting the past and the present systems of treatment of joint-disease. Starting with the premise, that in a healthy individual all the parts composing a joint are fit to endure without damage the usual tasks imposed on them during the average term of human life, we naturally proceed to inquire into the causes of inflammation, and of other morbid changes, as they attack some individuals to the exclusion of others. And these inquiries have taught us that the idea of general or local plethora to be encountered by repeated blood-letting, as practised by the older surgeons, is one which may lead us into error, and is far from being generally applicable.

It is doubtful whether the absolute quantity of blood in the body is subject to such changes as was once supposed; but its composition and the relative quantity of its constituents vary: thus, in plethora, according to

Rokitansky, we find an excess of red blood-corpuscles with diminished quantity of fibrine ; but we have yet to learn that the proper method of rectifying this condition is by the sudden abstraction of so many ounces.

For the treatment of "white swelling" we were once told, that "blood may be taken from the arm, and also from the diseased part, either by means of leeching or of cupping. Mr. Latta gives the preference to the latter method, whenever it can be employed ; and he very confidently remarks that little advantage can be expected from topical bleeding of any kind, unless the quantity taken away be considerable."* But more extended experience and independent observation have shown that the abstraction of ten to twelve ounces of blood by the cupping-glass, followed by the repeated application of sixteen to twenty leeches, can rarely be borne with advantage even by the strongest frame ; and that, in the class of cases now under consideration, it positively retards recovery, and is inadmissible.

In looking over the record of some cases of joint-disease treated upon the "antiphlogistic" principles of the past age, I could not fail to be struck with the great revolution of opinion which has taken place.

Many surgeons have made a wide distinction between the treatment of diseases and of deformities of joints, and have cultivated the study of the former to the exclusion of the latter, which have been consigned to the care of specialists. This is a grave error; the one may produce the other, and *vice versâ*. Thus disease may lead to contractions and other deformities of the limbs; while, on the other hand, deformities, if allowed to remain uncorrected, may be followed by impairment of nutrition, or by active inflammatory disease. It is true that the treatment of deformities is in a great measure, yet by no means entirely, mechanical; and this fact should induce surgeons to study more closely the mechanism and the mode of working of the different forms of apparatus which have attained a perfection heretofore unknown.

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* Cooper's 'Surgical Dictionary,' art. *Joints*, p. 786. Sixth edition.

I have viewed with regret a somewhat growing inclination for the early performance of operations, particularly resections; and, much as I admire the spirit of conservatism with which that proceeding is characterised, as opposed to amputation, yet must confess a misgiving as to its general applicability, and feel a desire that the advantages to be derived from mechanical treatment, and the enforcement of complete rest, should be tried more continuously and with yet greater patience.

CONTENTS.

CHAPTER I.

PAGE
INTRODUCTION: CLASSIFICATION OF DISEASES OF JOINTS 1

CHAPTER II.

GENERAL PATHOLOGY 8

CHAPTER III.

SYNOVITIS 18

CHAPTER IV.

DISEASE OF THE ARTICULAR EXTREMITIES OF THE BONES 36

CHAPTER V.

TREATMENT 54

CHAPTER VI.

DISEASES OF THE JOINTS OF THE UPPER EXTREMITY 91

CHAPTER VII.

DISEASES OF THE JOINTS OF THE LOWER EXTREMITY 117

CHAPTER VIII.

DISEASES OF THE TEMPORO-MAXILLARY ARTICULATION AND OF THE SPINAL COLUMN 152

CHAPTER IX.

PAGE
Morbid Changes in Muscles and Tendons 185

CHAPTER X.

Hysterical Affections of Joints : Wry-neck : Sprains 191

CHAPTER XI.

Injuries of Joints 215

CHAPTER XII.

Bursæ Mucosæ 222

CHAPTER XIII.

Talipes or Club-Foot 239

CHAPTER XIV.

On Rickets 269

CHAPTER XV.

On the Treatment of Cicatrices after Burns 285

CHAPTER XVI.

On the Treatment of Contracted Toes and Corns 289

CHAPTER XVII.

On Malignant Diseases 293

ON DISEASES OF THE JOINTS,

INCLUDING THE

NATURE AND TREATMENT OF DEFORMITIES.

CHAPTER I.

INTRODUCTION—CLASSIFICATION.

Not many years ago all morbid changes were regarded as the result of inflammation. We now recognise, as equally important, the effects of simple errors of nutrition or of faults of development. The function of nutrition is regarded by the best physiologists as consisting of "a series of changes in the alimentary materials, by which they are converted into organised tissues, and thereby acquire vital properties." * The new tissues, it is further stated, may constitute an augmentation of the previous fabric, or "growth;" or they may be *substituted* for tissues of an inferior order, called "development;" or they may simply replace the loss by disintegration, called "maintenance." For its continuance this function is dependent, according to the same authority, first, on the absorption of alimentary materials; secondly, on circulation; thirdly, on respiration; fourthly, on excretion.† It will be observed that the direct influence of the nervous system is here unnoticed.

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* 'Principles of Comparative Physiology.' By Carpenter. p. 351.
† Op. cit., p. 351.

Physiologists hold, at most, that it is exercised only indirectly, through the power which it has of affecting the size of the blood-vessels; and that consequently it influences only the degree, without at all affecting the mode, of nutrition of a part.

Simple maintenance may depend entirely on the absorption of food, on circulation and respiration, and on excretion, the whole being governed by chemical and physical laws; but both growth and development imply the exercise of some far higher power; one which, under all the varied circumstances of change, maintains the proper relation between the component parts of an animal and the conditions of the external world which surrounds it. This power does not, of necessity, require an "organised nervous system," for it exists in animals which apparently have none; likewise it is in force during the earliest period of inter-uterine growth: but nerve-influence is the best expression for the exercise of such forces. When any portions of the nervous centres are congenitally deficient, there is a corresponding arrest of development in all associated parts; when partial loss of nerve-power affects a limb, the component tissues wither and the different structures grow imperfectly; when the nervous system is depressed, convalescence is retarded. We are too apt, in the diagnosis and treatment of disease, to overlook this influence of the nervous system; we do not sufficiently inquire into the causes which may have affected it, either locally or generally, and thus paved the way to physical changes.

Whatever may be the decision of the profession on these questions, the practice in the treatment of disease points indisputably to the fact that we trust less to specifics, and more to all those agencies which invigorate the mind as well as the body. Such agencies have found their way into hospital practice as well as in private life, and constitute no unimportant means of producing results so favourable as to attract general notice.

In the study of diseases of the articulations, these questions acquire an importance which cannot be overestimated. Complete loss of nerve-power is followed by irreparable degeneration of the tissues, and the limb ceases to grow; it becomes cold and livid, the muscles are changed into fat, the bones are light and friable, the articular cartilage is thinner and easily separated from the end of the bone. No remedy has hitherto been able to arrest these changes. Electricity, constant frictions, medicated and otherwise, have been tried in vain. But if the nerve-power be once restored (and in some cases of infantile paralysis we witness it), the process of nutrition is re-established, the normal warmth returns, and growth proceeds as usual. Between this and that of healthy nutrition there is an infinity of gradations, down to the partial withering of a single muscle.

The surgeon has no fear of anchylosis or of atrophy in keeping a diseased joint at long-continued rest, neither does he fear the effects of the pressure of the bandage; the limb somewhat wasted by simple disease speedily regains its tone and normal bulk on the resumption of exercise, provided there be no complication of nerve-disease.

The influence of mind and of pleasant surrounding agencies on the progress of disease is too notorious to need illustration.

Classification of Joint-Diseases.—In most works on "diseases of joints" we read of inflammations, whether acute, sub-acute, or chronic, as occurring in the synovial membrane, cartilage, bone, or ligament, and this comprises the whole, or nearly so, of the pathological conditions. With this classification I find fault. In the first place, it omits all mention of deformities, whether congenital or acquired; it does not touch upon changes dependent on errors of nutrition; and it assumes the existence of inflammation in some tissues, such as cartilage, where such disease never occurs, or in others, such as ligament, where its presence is only secondary and dependent on inflammation spreading from other sources.

Two structures only of all those entering into the composition of a joint are liable to primary inflammation, namely,—

1. The synovial membrane.
2. The cancellous tissue of the head of the bone.

Consequently we speak of (*a*) synovitis, or inflammation of the synovial membrane; and of (*b*) inflammation of "the joint;" and by this latter term, namely, inflammation of a joint, we imply that the disease commenced in the bone and spread to the cartilage and other tissues, so that the whole joint has become involved. We no longer find it necessary to enter into a long disquisition as to whether hip-disease, for example, in strumous children commences in the synovial membrane, the bone, or the ligamentum teres. Experience, supported by pathological investigation, shows that faulty nutrition in a weakly child has rendered the head of the femur unfit, in point of strength, to support the weight of the body. Some over-exertion or a slight accident excites in it inflammation, which soon spreads to all the tissues around susceptible of such change. In a healthy child a similar accident would have been followed by no bad result.

Between inflammation of the synovial membrane and inflammation of a joint we cannot always draw the line of demarcation. In many instances the former is found to be dependent on the latter, but yet they may pursue their course distinct throughout. A case of hydrops articuli is disease of the synovial membrane. We search for its cause in weakened ligaments, in a gouty condition of constitution, &c. But in another case effusion into the synovial cavity may imply softening of the bone and partial detachment of the articular cartilage. The diagnosis between the two is not always easy.

In all countries these diseases are common among both poor and rich, but the poor are especially the sufferers; they cannot afford to notice early symptoms nor to give a sufficient time for convalescence, and yet diseases of joints are not of necessity fatal. During the year 1864 there were 86 cases of synovitis treated in St. Bartholomew's Hospital: of these 76 were discharged cured or relieved; of the 10 cases remaining 2 were discharged unrelieved, 1 died, leaving 7 cases still under treatment. During the same period there were 74 cases of disease of "the joint:" of these 54 were discharged cured or relieved; of the 20 cases not accounted for, 7 were discharged unrelieved, 11 died, leaving 2 under treatment. One female alone under twenty-five years of age died of synovitis. Four cases only (2 males and 2 females) died under the same age of disease of "the joint."

We are, therefore, justified in concluding that most of these cases, properly and timely treated, will recover, although they may be troublesome and tedious. Surgeons in public practice should not despond of success, nor fly at an early date to so serious a measure as amputation or the resection of a joint, because the parts do not speedily become sound. We dare not act so in private practice.

Taking, as an illustration, the hip and knee, these joints were resected in a general total four times during the year 1864 in St. Bartholomew's Hospital: the hip once and the knee three times. In the case of the resection of the hip, the patient died of exhaustion from suppuration. In the case of the knee, of the three patients, one died of pyæmia. I do not here enter into the question of the condition of the patients surviving, but would remark that the successful extirpation of a joint is a matter of congratulation, not only when it can be proved that it has been the means of shortening suffering or of preserving life, but when it leaves the patient a useful member. One object of this work is to call attention to the natural processes of repair, to point out how much may be done, even in the most unpromising cases, by combining mechanical with general treatment, and the strict enforcement of rest. Inflammatory diseases of the joints are thus arranged :—

PRIMARY INFLAMMATIONS.—1. Synovitis; 2. Inflammation of the Joint.

Synovitis.—*a.* acute, *b.* sub-acute, *c.* chronic. Specific inflammations: rheumatic, arthritic, gonorrhœal, scrofulous.

Inflammation of the Joint, i. e. *Inflammation, acute and chronic, of the cancellous tissue of the head of the Bone.*—Primary effects: suppuration, necrosis. Secondary effects: separation and ulceration of the articular cartilage, elongation of ligaments and dislocation from disease. Specific inflammations: rheumatic and scrofulous.

Other diseases, proceeding from errors of nutrition or of development, we include under the head of deformities, which are divided into *a.* congenital; *b.* acquired.

Next come malignant diseases.

Lastly, sprains and other injuries.

That which is called "orthopœdic surgery" cannot, as it now stands, lay claim to much that is scientific, and its sphere of application has hitherto been limited; but yet it contains principles which are true, and which have been carried out with success. There is no reason why these principles should not be generally recognised and acted on, nor why surgeons should not avail themselves more generally of the different appliances which experience has shown to be useful.

A complete account of the pathology of joints would exceed the limits of this work. Illustrations, however, have been given of the principal morbid changes, and I have endeavoured, as far as possible, to limit myself to my own opinions rather than to give a general *résumé* of those of others.

CHAPTER II.

GENERAL PATHOLOGY.

Synovitis.—We have no means of demonstrating in the human subject the early morbid changes which occur in acute inflammation of the synovial membrane; and must therefore refer to the experiments performed by Richet, of injecting irritating fluids into the articulations of animals. The immediate effect was a vivid injection of the blood-vessels; the epithelial covering was thrown off; the membrane lost its bright, glistening aspect, and became uneven, granular, or velvety: soon its roughness increased, and it became covered with small processes $\frac{1}{2} - 1$ line broad and $\frac{1}{4} - \frac{1}{2}$ line high, which were undoubtedly the swollen and enlarged papillæ of the synovial membrane. The vascular injection, which at first terminated abruptly at the border of the articular cartilage, soon encroached a little on its surface, and then there was seen a bright vascular zone, surrounding and strongly contrasting with the white and unaltered cartilage, and overlapping it to the extent of a line to a line and a half. This vascular zone or fringe increased in size, and encroached on the cartilage the more it became infiltrated and swollen; while the enlarged papillæ acquired the magnitude of two lines and a half. Contemporaneously with these changes, a layer of fibrine became effused on the inner surface of the synovial membrane, giving to it increase of thickness. The synovia lost its clearness and transparency, and its thick viscid consistence. It became turbid, mixed with reddish serum and oil-globules, and often increased in quantity. Richet never witnessed the *dryness of the synovial membrane*, described by some authors as the prelude to other inflammatory changes.

The immediate effects of acute inflammation on the synovial membrane of man appear to be similar to those here described, except that pus is more rapidly effused, and the destructive process is quicker, especially in the larger joints, such as the knee. Although we have few means of ascertaining the amount of redness, yet we find the synovial secretion rapidly increased; and in most instances in which an opportunity of microscopic examination is afforded, pus-corpuscles are found floating in it in great numbers. The deposit of lymph on the inner surface of the synovial membrane is often abundant; flakes are found adherent to the articular cartilages. In some instances the synovial membrane is soft and swollen, and the layer of effused lymph thin.

The injection of the blood-vessels and the redness of the synovial membrane in one case related by the late Sir B. Brodie was such, that, from his account, " throughout the whole of its internal surface, except where it covered the cartilages, it was of a dark-red colour, like the conjunctiva in acute ophthalmia." The effusion of serum may be such as to distend the synovial membrane to its uttermost, and render it hard and unyielding. In yet acuter cases the whole cavity is filled with pus. Cases occur in which the effusion is so rapid, the tension so great, and the pain so severe, that the surgeon has been compelled to let out some of the fluid by a puncture into the joint. Such treatment is commonly followed by aggravation of all the symptoms, and great increase of pain.

In contrasting, however, the experiments on animals by Richet, with the effects of synovitis in the human subject, we must take into consideration the fact that the former were in perfect health, while the latter are mostly the subjects of rheumatic, of gouty, or strumous disease. Cases of uncomplicated synovitis in man recover for the most part without difficulty. The extirpation of a loose cartilage from the healthy knee of a boy, involving an incision into the synovial cavity, will close without trouble; but where we have to deal with subjects of maturer age and of unhealthy constitution, the conditions are widely altered.

Severe as are those complications called scrofulous, rheumatic, or gouty, there is yet another which often masks the early character of synovitis. It is when the inflammation of the synovial membrane is a secondary disease, transmitted by some morbid condition of the articular extremity of the bone. Under these circumstances rest will bring temporary relief. Medical treatment will temporarily palliate symptoms; but sooner or later suppuration of the synovial cavity will ensue, and the limb or the joint will probably be lost. Of such a class of cases were possibly those related by Mr. Bryant, who observes: "In acute synovitis, when unchecked by treatment in its early stage, and when suppuration of the joint has taken place, a fatal termination must generally be anticipated if the seat of the disease should be in one of the larger joints, as the hip or knee; some successful cases undoubtedly occasionally take place, but they are few and far between, and then often with the loss of the limb. Out of twenty-five cases of acute synovitis which I have before me, eleven died."*

In May, 1850, I had the opportunity of examining a limb in which the knee-joint had been punctured by a surgeon in the hope of relieving his patient, suffering from acute synovitis. So severe were the symptoms, both local and constitutional, which quickly ensued, that after three months the limb was amputated. On examination it was found that the tibia and fibula were thrown somewhat forwards; the patella was movable, and rested against the external condyle of the femur. The knee-joint presented three compartments, in consequence of the adhesions of the synovial membrane—one between the outer condyle of the femur and the corresponding articular surface of the tibia; a second between the patella and the front of the femur; the third between the inner condyle of the femur and the inner articulating surface of the tibia. In the first and second of these compartments the cartilage was becoming thinned; in the third all the cartilages were removed; the bony surfaces were rough and almost locked into one another; fragments of bone were nearly detached from both tibia and femur, and were ready to drop into the joint. The synovial membrane, where it still remained, was pulpy, thickened, and of light-brown colour. Some parts were separated from the rest, and contained circumscribed collections of thick pus. Fistulous passages extended from the integument into the joint, one of which passed a long way into the popliteal space. The external lateral ligament was softened and elongated, but entire; the internal was softened and spread out, and much changed from its natural appearance. The surrounding tendons were normal in appearance; but the muscular fibres were pale and friable and soaked in effused serum.

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* 'On Diseases and Injuries of Joints,' p. 17.

It must be remembered that bursæ often communicate with the cavity of the joint, and that they may undergo the same morbid changes as the synovial membrane. After repeated inflammation, followed by chronic distension of the synovial cavity, the surrounding ligaments become elongated and softened when the joint is rendered loose and weakened, and is apt to give way. But to this subject we shall refer elsewhere.

A question arises, whence comes this pus, which in some cases so rapidly fills the synovial cavity? Rokitansky clearly is in error when he asserts that "the firm, shreddy layer of lymph lining the membrane is *dissolved into pus*." We have no evidence that fibrinous exudations undergo, under these circumstances, other changes than those either of consolidation and organisation or of absorption.

There are two doctrines as to the origin of pus—first, according to Rokitansky, that the fluid is formed by a change in, or degeneration of, the plasma of the blood; secondly, according to Virchow, that it is formed by a rapid cell-growth set up by irritation in the parenchyma itself. The cells from which Virchow considers pus-cells to be generated are the corpuscles of areolar tissue (Bindegewebs-körperchen), which he supposes to permeate every part of the frame.*

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* Article, *Abscess*, 'Holmes' Surgery,' vol. i. p. 140.

Modern pathologists do not regard pus as degenerated lymph, but as a fluid composed of cells generated abnormally, and external to the vascular system. In the case now before us the pus must be generated from the synovial membrane, and from no effused and degenerating product. That pus admits of both secretion and of absorption is sufficiently proven; but its presence in large quantity in a joint, actively inflamed, is a circumstance to excite the most lively apprehensions for the safety of the limb. Dr. Volkmann (‘On the Catarrhal Forms of Joint Suppuration,’ Archiv. f. Chir., vol. i. pl. 2, p. 408) ascribes the easy production of what he calls catarrhal pus-corpuscles on the inner surface of the capsular ligament to the thick clothing which it has of pavement epithelium. An attempt has been recently made to arrange suppuration of this kind into two sharply-defined classes, namely, the destructive or that involving the connective tissue, and the catarrhal or epithelial suppuration—views which are based on the assumption, that either the younger epithelial cells, by repeated subdivision, are resolved into the elements of pus, or that an endogenous formation of pus takes place inside the epithelial brood-cells. And Dr. Volkmann traces the origin of the pus in catarrhal articular inflammation to the metamorphosis of the more superficial connective-tissue corpuscles into small foci filled with pus-corpuscles, which empty themselves into the cavity of the joint after exfoliation of the superjacent epithelium. He sums up the results of his observations in these words: “Joint suppuration has in many cases at first the secretory (catarrhal) character. Probably pus-corpuscles are found in moderate numbers in all the more acute arthro-meningites, and produce here the universally-known, and in many cases more or less pronounced, yellowish turbidity of the inflammatory products. The formation of the pus-corpuscles is often so abundant, that the effusion appears completely puriform, although all the deeper (parenchymatous) alterations of the constituent tissues of the point are absent. In all these cases the pus may disappear either by disintegration of its corpuscles and absorption, or by evacuation, and a cure result without any trace of the former disease being left. In all cases of acute formation of pus in previously healthy joints, the suppuration of the synovial membrane has at first only this secretory character; the deeper and irreparable changes occur later."*

The views thus expressed, in language somewhat different from that of English writers, are nevertheless confirmed in greater part by experience. The constant presence of pus-corpuscles in all inflammatory secretions from the synovial membrane, the ready disintegration and absorption of such corpuscles, are facts as well established as that of the rapid destruction of the entire joint in the severer forms of suppuration. It was the opinion of the late Mr. Stanley, that a large joint distended by pus, as a product of acute inflammation, was irretrievably lost; and my own experience is very much in confirmation of this view. The pus may in some rare cases make its way through the membrane and burst externally, or the surgeon may make an opening into the joint; in either case the risk to the patient seems nearly similar. But it should be considered that in such cases all the tissues of the joint are involved, and we are possibly dealing with cases of deep-seated joint-disease.

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* 'Yearbook of Surgery,' 1861, p. 273.

Pyæmia.—Deposits of pus in joints, under those peculiar circumstances designated by the term Pyæmic, are remarkable, inasmuch as the surrounding structures usually exhibit no traces of inflammation. There are, however, frequently combined with such purulent deposits, abscesses in the muscles, or deposits of pus in the sheaths of the tendons, in those cases in which the proper structures of the joint are diseased. No part of the body is exempt from this affection, the deposit of pus having been noticed in all articulations from the hip or shoulder to the joints of the toes or fingers. It occurs in all ages from infancy to the decline of life.

It is believed that in such cases pus has become mixed with the blood, poisoning it, and producing great general depression, its invasion being characterised by "shivering fits," which are distressing to the patient, and a source of just alarm to the surgeon. The idea that the cause of mischief was the fact of pus making its way into the blood was supposed to be confirmed by Cruveilhier's experiments, of injecting mercury into a vein, after which there was found in the centre of each of the small abscesses a globule of the metal, which seemed to have been carried by the circulation to the part where it was deposited, and where it excited inflammation, passing into suppuration about itself. "The pus globule was supposed to act in the same way as the globule of mercury: being too large to traverse the capillary channels, it was arrested there; and similar obstructions taking place in other points of the same organ, a number of separate inflammations, which soon suppurated and formed the so-called multiple abscesses, were thus established."* This view, however, appears too mechanical to be satisfactory.

Mr. Callender is of opinion ('Holmes' Surgery,' vol. i. p. 266) that "many writers confuse two diseases under the name of pyæmia, or puriform infection—one, the primary or direct consequence of a poison, in which fluid elements are, it is probable, chiefly concerned; the other, a secondary complication, but in itself distinct, and often independent." Animal or septic poison introduced into the system, he adds, is the cause of the primary disease, systemic infection. In the second modification the action of the animal poison is purely local. Whether this distinction be true yet remains to be established; but the circumstances under which pyæmia is generated point to the fact of general "blood poisoning," of a character most probably varied in the extreme, and by no means satisfactorily made out. Among the predisposing causes, Mr. Callender enumerates (Op. Cit. p. 268): "*a.* Previous illness, either of a chronic character, or specially connected with blood-disease from which the patient is slowly and with difficulty recovering, as pneumonia, dysentery, or scarlet fever. *b.* Extreme prostration of the system from organic disease, as phthisis of the lungs, degeneration of the kidneys—conditions often associated with the desponding state of mind noticed in this malady, and by some accounted its cause. *c.* Exhaustion consequent upon surgical complaints, with the eventual shock of an operation, as in diseases of joints, severe fractures of bone, cancer of the breast, ending in amputation. *d.* Parturition, difficult and protracted, or overtaking women in feeble health, more especially if symptoms arise in the treatment of which depletion is employed, or if in this, or in the previous conditions, diarrhœa or vomiting should interpose. *e.* Effect of unhealthy occupations and exposure, as during the late war in the Crimea, of which Mounier states, that no pyæmia was noted among the first two thousand amputations, whilst afterwards it became of quite ordinary occurrence, associated with gangrene, scurvy, and typhoid fever. *f.* Over-indulgence in food or in spirituous drinks; sudden abstinence from such indulgences; and, lastly, certain conditions which would seem to be hereditary."

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* 'Pathol. Anatomy,' Jones and Sieveking, p. 132.

Respecting the mode in which the pus is conveyed to and deposited in a part, and the phenomena attending its infiltration of tissues, or its collection into an abscess, there is not at present any satisfactory explanation. There is no positive evidence that the symptoms of acute pyæmia are in all cases due to the embolism of a vessel, or that a plug of coagulated blood carried into the circulation breaks up and stops some of the smaller vessels, forming there a centre around which pus forms. That such plugging of vessels does occur we have ample proof; but not so that it is an invariable law in pyæmia. The pus from these secondary abscesses is often extremely white and thick, and the shoulder is not an uncommon situation for their formation.

CHAPTER III.

SYNOVITIS.

Acute synovitis may proceed from exposure to cold, from blows, wounds, and other injuries, or may arise spontaneously in constitutions of rheumatic or gouty character. It is generally attended by feverish symptoms; and in the rheumatic form the pain is very severe, when two or more joints may be simultaneously affected; the heart and pericardium are also frequently implicated.

The attack is often preceded by a feeling of discomfort and tightness of the limb, by shivering, loss of appetite and rest. In other cases the swelling of the joint is immediate; and the shape which it assumes is regulated by the anatomical relations of the synovial membrane. The limb is thrown into the semiflexed position, because the lateral and other ligaments are then relaxed, the bones are held more loosely together, and there is less pressure on the inflamed tissues. In most cases there is some limited degree of movement, and the ends of the bones may be pressed together without pain; but the patient prefers keeping the limb at rest and semiflexed, and seems fretful and disquieted when the position is altered.

In the greater number of cases this state of the joint, after lasting a week or more, slowly subsides, the effused fluid is removed, the normal shape is restored, and the patient recovers, a feeling of weakness alone remaining.

Mr. Hilton has put the question, "Why is an inflamed joint fixed and flexed? It appears to me," he says, "to result from the circumstance that the irritated or inflamed condition of the interior of the joint (say the knee-joint), involving the whole of the articular nerves, excites a corresponding condition of irritation in the same nervous trunks which supply both sets of muscles, extensors and flexors; but that the flexors, by virtue of their superior strength, compel the limb to obey them, and so force the joint into its flexed condition. The joint then becomes rigid and flexed because the same nerves, which supply the interior of the joint, supply the muscles also which move the joint.

"This anatomical arrangement, physiologically considered, and rightly interpreted, may be made the means of explaining some of the most prominent symptoms of joint-diseases, and of constituting a foundation for the required treatment of diseased joints by rest, which I propose to advance and recommend.

"In order to place this important anatomical, physiological, and pathological subject comprehensively and definitely forwards, I will state it thus: *The same trunks of nerves whose branches supply the groups of muscles moving a joint, furnish also a distribution of nerves to the skin over the insertions of the same muscles; and what at this moment more especially merits our attention—the interior of the joint receives the nerves from the same source.*"*

Treatment.—Cases of uncomplicated synovitis mostly recover readily under the simple treatment by rest. The patient should be confined strictly to bed; the limb should be supported on a soft pillow in the semiflexed position; the heat of skin should be subdued by the application of a cold lotion, or by the use of an irrigating apparatus; moderately-nourishing diet should be allowed; the bowels must be regulated, but not purged; and an opiate should be given at night time, if necessary.

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* Hilton, 'Lectures on Rest and Pain,' p. 156. 1863.

The abstraction of blood, either generally or locally, is by no means universally applicable. Nor can such a measure be required except in some rare cases, characterised by the highest degree of sudden tension of the joint, by great heat of skin and great pain, by dry tongue, thirst and headache, by full and hard pulse, and other symptoms of violent vascular excitement. I prefer the abstraction of blood by the cupping-glass to venesection; in other cases relief may be obtained by the repeated application of leeches, in numbers varying from twelve to eighteen at a time. A young man was under my care, in 1862, suffering from traumatic synovitis, in whom relief from pain was obtained only by this last-named measure. I am no advocate for the general use of mercurials, so as to induce salivation in cases of acute synovitis, although such a measure has found favour with many surgeons. It was supposed to prevent the spread of the inflammation to the bone and cartilage; the evidence of such benefit rests on insufficient proof.

All surgeons are agreed as to the danger of making a puncture into the synovial membrane in these cases, even when the distension is extreme. I have seen two or three cases in which such a measure has apparently given relief; but it is always hazardous, the danger being rapid suppuration in the joint, the non-closure of the wound, and death from exhaustion.

In the event of a case of acute synovitis not rapidly improving, we find that it either subsides into the subacute or the chronic form, or that it is not a pure case of synovitis: we must conclude that the synovitis is secondary, and that it depends on inflammation of the bone; in other words, that it is a case of an "inflamed joint."

To these points attention shall be directed in another chapter.

Acute synovitis may be, as already mentioned, of rheumatic character, when generally two or more joints are affected at the same time, the stress of the disease, however, confining itself to one in particular. The symptoms in most points agree with those already mentioned. The pain is generally very severe, so much so that the patient cannot bear the approach of the hand nor the pressure of the bed-clothes. The temperature obviously is high, the skin sometimes reddened. There is swelling, which is partly due to exudation among the parts proper to the articulation, partly to effusion into the subcutaneous tissue, which gives to the skin a bright, glistening appearance. In the larger joints, such as the knee, the increase in quantity of the synovial fluid is obvious partly by a feeling of fluctuation, and partly by a recognition of the fact that the patella is raised from the front of the femur. The arteries beat with greater force than natural; the veins are fuller than normal.

With this condition of disease of a joint there is often combined a muscular rheumatism, namely, muscles, tendons, nerves, and areolar tissue about the part are painful, swollen, and œdematous; and on examination after death, such morbid changes are confirmed by observation. The general symptoms of fever are in proportion to the severity of the case. There is heat of skin, thirst, and loss of appetite; pulse, 100 to 120. The composition of the blood is always altered; the fibrin is increased in quantity; the albumen diminished; and there is acid reaction. As a rule, in acute rheumatism, the quantity of fibrin increases in proportion to the intensity of the disease, and diminishes with the cessation of pain and fever. Andral and Gavarret drew up the following table from forty-three venesections:—

	Water.	Fibrin.	Blood Corpuscles.	Serum Residue.
The highest number ..	839·6	10·2	130·0	104·8
The lowest number ..	771·6	2·8	70·0	76·9
The middle number ..	805·4	6·7	101·0	86·0

It has been supposed that the amylaceous substances in the body, which finally, by the act of respiration, become converted into carbonic acid, are changed, under pathological conditions, into lactic acid, and remain as such in the system. The consequence of this would be diminished alkalinity of the blood. Under other circumstances connected with the imperfect assimilation of food, which are still not understood, either an excess of lithic acid or of oxalic acid forms in the system. These substances accumulate in the blood, and pass thence into the urine; but in either case they give rise to morbid phenomena and to local diseases, such as, among others, are comprised under the head of inflammatory affections of joints.

Further observations and chemical investigation are yet required on this important subject.

The skin in this disease throws off a fluid generally acid, but sometimes alkaline. There may be the vesicles of sudamina or miliaria, or in other cases an erythematous rash. The urinary secretion is diminished in quantity: it is of yellowish-red colour and very acid; and yet it is said that the absolute amount of acids contained in it is rather diminished than increased—that is to say, that the quantity of acid voided during the twenty-four hours is less than that in the urine of a sound person during the same period. Upon cooling, the urine always throws down a copious precipitate of lithic acid and its salts.

Dr. King Chambers has observed, that of 26 cases treated with ʒi. of nitrate of potash three times a day, the mean stay in hospital was forty days; of 341 treated with a less quantity of the same, forty days; of 11 treated without drugs, except a little opium occasionally, thirty days; of the 26 treated with nitrate of potash, 5 were attacked with heart-disease while under treatment, and 4 died: of 174 treated with bicarbonate of potash, 9 had inflammation of the heart, and none died; of 63 either bedded in sheets or who had wilfully thrown off their blankets, 6 contracted, newly, pericarditis at least, if not endocarditis as well; 3 had a relapse of pericarditis on old cardiac disease; 5 had endocarditis alone (one of them accidentally from a wetting during convalescence); 1 a relapse of endocarditis on old cardiac disease. Not four per cent. had inflammation of the heart. When it came it was of milder character, and was generally to be accounted for by some imprudent exposure—that is to say, that bedding in blankets reduces from 16 to 4, or by a good three-quarters, the risks run by patients in rheumatic fever.

In the treatment of rheumatic synovitis warm applications are generally more grateful to the patient's feelings than cold; and the abstraction of blood is less frequently practised than in other forms of synovitis. We administer lemonade as a drink, and the bicarbonate of potash, with the nitrate, in doses varying from fifteen grains three times a day. In other cases colchicum or iodide of potassium has proved useful; opium; morphine, alone or combined with calomel, has been given as symptoms indicate their use. Many surgeons prefer the compound ipecacuanha-powder, in doses of three to five grains three times a day. Should it be deemed necessary to abstract blood, leeches should be employed in sufficient numbers, viz., x. to xvi. at a time; and no application is more comfortable than a poultice composed of bread and linseed. In cases where the pain is very severe, morphine may be injected hypodermically; blisters, or the blistering fluid is a fitting agent, when the acute symptoms have passed.

After a time tonics, especially the sulphate of quinine, are used with great advantage; and the joint may be supported by strips of unirritating strapping and a roller. During the course of the disease the whole limb should be gently raised on a pillow.

The treatment of pyæmic blood-poisoning, producing purulent deposits in joints, is a subject which would lead me from the proper limits of this work. Thus much, however, may be said, viz., that our efforts must be directed to the maintenance of the patient's strength by the administration of wine, brandy, and other stimulants, by the employment of tonics, the free use of generous diet. Abscesses should be opened as they form and are detected; but the dangers of this disease consist in the deposit of pus in internal organs, such as the lungs or the liver, where their presence may be suspected, but can rarely be proved during life.

Cases of "acute synovitis" have been recorded from the passing of a catheter, or of the instruments used in the operation of lithotrity. A patient, seventy years of age, died seven days after the performance of this operation by Mr. Coulson. In the left knee-joint there was found a quantity of thick chocolate-coloured fluid; the synovial membrane was strongly injected; the cartilage covering the external condyle was softened and "ulcerated" in the middle, the bone being denuded in the point. The corresponding cartilaginous surface of the patella was superficially ulcerated. Some pus was found in the right knee-joint of natural colour and consistence, but the articular cartilage was here ulcerated. The head and the right femur was injected red, and the synovial membrane was very vascular.* Was not this a case of blood-poisoning?

A milder form of the disease was first described by the late Sir Benjamin Brodie, and is now sometimes called gonorrhœal rheumatism. It may be combined with an inflammatory condition of the conjunctival membranes of the eyes, and is very obstinate in its progress. Mr. Barwell considers it to be "in reality a slower form than ordinary of purulent infection produced by inflammation of the prostate veins;" but he confesses that he has no cases of dissection to prove this position.

This form of the disease is not usually fatal, although it may leave the patient much crippled.

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* 'Lancet,' 1852, vol. i. p. 533.

Many are the forms in which pyæmia attacks a joint. A patient of mine living in an unhealthy locality, though in comfortable circumstances, was the subject of a painful condition of the left tibia, near the ankle. It was not, however, sufficiently severe to keep him at home. On one occasion he exposed himself to cold and over-fatigue. The knee-joint became swollen; and when I was called to see him I found that suppuration had ensued in the synovial cavity. The patient was at that time delirious, and he survived the operation of amputation only five days. The knee-joint was found completely disorganised.

Sub-acute inflammation comprises those cases in which the joint is liable to become slowly and moderately distended on any exciting cause, such distension being rarely attended with either much pain or constitutional disturbance. The limb feels stiff, numb, and heavy, and the patient cannot use it as usual. At the commencement the swelling subsides under the influence of rest; but when the parts are moved, a recurrence of the symptoms is apt to ensue, and with each return of the effusion the ligaments and the synovial membrane become soft and yield, so that the articular cavity is at last greatly enlarged. If we again take the knee-joint as an example, we find in patients, obliged to walk, that some deformity speedily supervenes.

Hydrops articuli, or distension of the synovial membrane by a large amount of thin synovia, is one of the results of sub-acute synovitis. In this disease the inflammatory symptoms are very slight, and the morbid changes at first inconsiderable. Bonnet divides hydrops articuli, or hydrarthrosis, into acute and chronic; but English surgeons, I think, recognise only the latter variety.

The causes of the disease are either external or internal. Among the former we recognise knock-knee or bow-legs, such deformities rendering a person uncertain in his gait, apt to slip and fall from stepping on any irregularity of the ground.

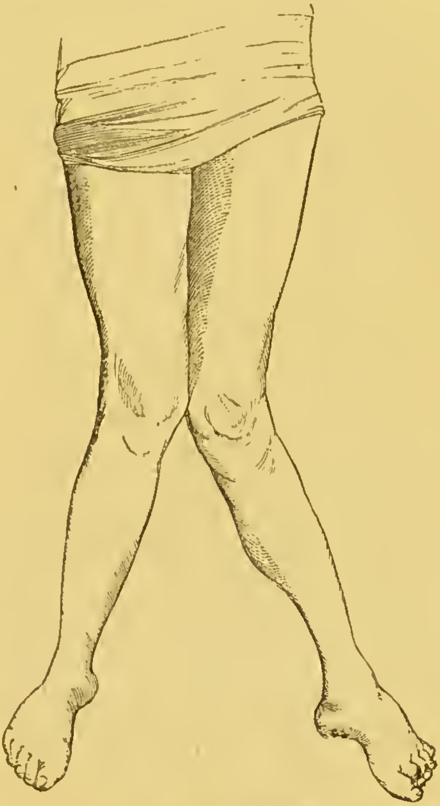

Fig. 1.—Knock-knee.

Among the internal causes we include the effects of rheumatism and gout, especially the former. The lateral ligaments and the capsule slowly yield to the distending force, and become elongated and loose, so that the bones are held lightly together, and lose much of that support which such structures should afford them.

The larger joints, such as the hip, the knee, or the elbow, are generally those affected, and the distension is considerable. The contents of the cavity, according to Bonnet,* resemble in all points the fluid which is found in a hydrocele, inasmuch as it is transparent, of yellow or yellowish-brown colour, is not stringy, but coagulates with heat.

Gurlt affirms that there are without doubt cases in which no injection of the synovial membrane can be discovered, and he quotes instances of the disease, as noticed in horses (Gelenkgallen); but even here the remark is exceptional.

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* 'Traité des Maladies Articulaires,' p. 431.

That stretching and relaxation of the ligaments consequent upon effusion into the knee-joint is not uncommonly followed by an outward inclination or "bowing" of the limb is shown by the following case. On Aug. 27, 1863, a man, aged forty-three, presented himself at the Orthopœdic Hospital with strongly-marked bow-leg affecting the left limb. Eight months previously he had had an attack of "chronic synovitis," which left the knee weak; but the outward inclination of the limb was of three months' duration, and had of late become considerably more severe. He was directed to wear, both by day and night, an inside splint of wood, under which treatment he rapidly improved; but the continuance of the support over a period of many months was necessary, so that the stretched ligaments might have time to recontract to their normal length and to become firm.

After some diseases, and especially rheumatism, the effusion into a joint may be so great as to push a bone from its socket, and lead to secondary displacement. Cases of dislocation of the femur on the dorsum ilii from this cause have been related by the late Mr. Stanley, in the twenty-fourth volume of the 'Transactions of the Medical and Chirurgical Society.' In one case the capsule was entire, but its cavity measured four to five inches in length. The cavity of the acetabulum had almost disappeared, being both reduced in size and filled by fibrous tissue. The ligamentum teres was absent. The capsule around the neck of the femur presented a fringe of slender growths. The specimen is preserved in the Museum of St. Bartholomew's Hospital. Other similar cases are on record. Attempts have been made during life to pull down the dislocated bone and to replace its head within the socket, and in some instances the first part has been accomplished; but no amount of ingenuity nor any form of apparatus has hitherto succeeded in keeping the bone there in any case which has fallen under my observation.

Treatment.—In cases of sub-acute synovitis the abstraction of blood is rarely necessary; nor is there commonly such an amount of pain as to indicate the administration of opium. Patients generally are improved by the use of tonic medicines; and it is in these cases that pressure, carefully and equally applied, is of great service. The joint may be surrounded by strips of soap-plaster, by a starched roller, by a leather or gutta-percha case; the great object being to favour the absorption of the effused fluid, and to give, by means of continued support, some chance to the ligamentous and fibrous structures of recovering from the state of extension into which they have been thrown. In the treatment of cases complicated with knock-knee, an outside splint is sometimes useful. For instructions as to the making of immovable bandages, *vide* page 55, and for the application of outside splints *vide* page 281.

Chronic Synovitis.—Chronic inflammation of the synovial membrane is attended by an increased secretion of synovial fluid, and by thickening of the membrane itself. In one specimen (Ser. II., No. 24, Museum, St. Bartholomew's Hospital) the internal surface was found granulated, and the membrane universally thickened. It was not less than two inches thick in the front part of the knee, and quite of a gristly nature. In some cases there are collections of pus between the layers of the thickened synovial membrane. In others the membrane is so elastic as to communicate a sensation of fluctuation. A patient, the subject of this affection of eleven months' duration, complained of great weakness in the limb, and of a gnawing pain in the bone. The weakness often proceeds from softening and elongation of the ligaments, of which the natural firmness is lost. The gnawing sensation is due to changes in the bone itself.

I have noticed in the early stages of chronic synovitis of the knee a peculiar grating sensation when the patella is touched. It is as if two rough bony surfaces were rubbed one against the other; but after a time it disappears. I cannot explain the exact morbid condition which gives rise to it. It cannot be due to any morbid condition of the bones, inasmuch as it soon passes away; and it differs in intensity from that sensation which indicates the destruction of the articular cartilage and the denudation of the cancellous tissue.

This thickened state of the synovial membrane may last for many months, or even for years, the parts being swollen and the limb semiflexed; the skin slightly hotter than natural, and the joint liable to become painful on exposure to cold, or from over-exertion. Under circumstances favourable to recovery—that is to say, the enjoyment of fresh air, nourishing food, and proper medical care—the patient may find his condition very tolerable, and may look forward to a considerable amount of recovery when that state of constitution which rendered him prone to disease has passed away. The infiltrated fluids become absorbed, and the membrane regains much of its normal delicacy; but the secretion is not restored in perfection until long afterwards, and the joint remains more or less stiff for months or even years.

But in other cases the surrounding conditions are unfavourable for convalescence; the state of constitution is feeble; the patient is liable to tuberculous deposits; he is bound to exert himself for the maintenance of others. Under such circumstances, repeated and continued attacks of low inflammation lead to permanent thickening of the membrane. The lateral ligaments become soft and readily elongated, so that in such a joint as the knee, where there is no mechanical locking of the bones, a subluxation readily ensues, which it is difficult, if not impossible, to rectify.

It would be erroneous to describe these cases as instances of uncomplicated synovitis. The cancellous tissue of the bone usually participates in the disease to a greater or less extent, and in many cases may be regarded as the source of all the mischief. We find, upon close examination, increased heat, tenderness, and slight swelling of the bones, with increased vascularity; and examination of such bones shows expansion and congestion of their tissues, the medulla in their cells being mixed with blood; the earthy matter is slowly removed, so that the bone is rendered soft and compressible.

These cases therefore may be said to hold an intermediate position between cases of "synovitis" and of "general joint-disease." Commencing in the former, they may readily pass into the latter category.

This disease of the synovial membrane affects either sex in nearly equal proportion, but is more common in childhood than in adult life. The larger the extent of the synovial membrane, and the more exposed to the effects of violence and cold, so much the more liable is it to inflame. Hence the knee-joint is so frequently the seat of disease; and Mr. Bryant calculates that in about seventy-seven per cent. of all cases this articulation is attacked.* It is this disease which constitutes the ordinary form of "white swelling," a term now seldom used by English authors.

There are cases in which a layer of lymph or fibrine is effused on the synovial membrane and becomes organised, contracting adhesions with the opposed surfaces. This constitutes one form of fibrous anchylosis. There is a specimen of a knee-joint in the Museum of St. Bartholomew's Hospital exhibiting these effects. "An abundant deposit of lymph has taken place from the internal surface of the synovial membrane, and thin flakes of it adhere to the articular cartilages." (Ser. II., No. 3.) Generally, however, the effusion of fibrine, and the formation of adhesions, are changes which supervene upon disease of more chronic character. They constitute the usual method of repair, uniting parts which have become loose, weak, and preternaturally movable, or which, from other changes, are no longer fit for the normal movements, such as the articular extremity of a bone roughened and deprived of its cartilage.

But chronic synovitis, with its concomitant thickening, as seen commonly in unhealthy subjects, or in strumous children, must be distinguished from that peculiar light-brown coloured degeneration of the synovial membrane, to which particular attention was first directed by Sir B. Brodie. "This latter disease," he says, "seems to commence in the reflected portions of the synovial membrane, converting them into a light-brown pulpy substance, varying from a quarter to a half, or even a whole inch in thickness, intersected with white membranous lines and red spots formed by small vessels injected with their own blood. It then attacks the synovial membrane of the 'cartilages,' beginning at their edge, and extending gradually over them, ulceration in those cartilages going on correspondently till the carious or ulcerating surfaces of the bone are exposed. The cavity of the joint sometimes contains pale yellow fluid in the floating flakes of lymph, or pus, which is discharged externally by ulceration, but sometimes neither; or abscesses may exist in the altered synovial membrane itself, without communication in the joint."

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* 'Diseases and Injuries of the Joints,' p. 3.

The infiltration and thickening of the surrounding textures increase as the disease proceeds. They become filled with a thick lardaceous deposit which softens and amalgamates the different tissues. The ligaments become elongated. In many joints the relation of the bones becomes altered, and a partial or subluxation ensues; the skin ultimately becomes adherent, and ulcerates.

This pulpy degeneration of the synovial membrane is a peculiar change. It is often mistaken for the thickening of common chronic synovitis, from which it differs. In a case examined by me Dec. 3rd, 1846, for the late Mr. Stanley, the encroachment of the synovial membrane on the cartilage was considerable; the cartilage itself was loosened from the bone, which was more vascular than natural, but of usual firmness. Several of the glands in the popliteal space had undergone the same degene-

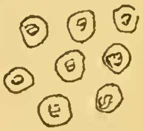

Fig. 2.—Corpuscles from Diseased Synovial Membrane.

ration. I could strip off some of the pulpy mass, covered by epithelium, from the vascular layers of the synovial membrane on which it lay. The surrounding vessels, in these cases, become the seat of very active circulation.

We have a specimen (Ser. II., No. 12, Museum, St. Bartholomew's Hospital) showing an elbow-joint, in which the synovial membrane is converted into a light-brown substance of firm texture, about half or three-quarters of an inch in thickness, with white lines running through it in various directions, and with a soft, smooth surface. In this case the patient was sixty years old, and the disease had existed fifteen months. It originated in a blow, after which the joint remained very stiff, but without pain and with little swelling, for twelve months. Numerous small swellings, like enlarged glands, then formed around the joint; they inflamed, and when punctured discharged a glairy fluid. The disease outside the joint increasing, the limb was amputated.

Chronic Rheumatic Inflammation.—The general symptoms in these cases are not by any means so severe as in the acute form. There is, however, increase of heat and swelling of the joint, which appears more considerable from the wasting of the limb. The bones are often partially displaced, osseous projections and tuberosities are unduly prominent, there is stiffness, or anchylosis, &c. The morbid changes attending this affection, now well studied, have been already described. When fever is present, it is mostly secondary, and indicative of some active mischief, such as suppuration or ulceration, going on in the bone. The patients are peculiarly susceptible of cold, and derive great benefit and ease from the application of warmth to the affected part. There is rarely any complication of heart-disease, but the muscles are painful and the veins often obliterated. According to most observers, it is more frequent in women than in men, and, for the most part, occurs in advanced life.

The different methods of treating the effects produced by chronic inflammatory affections of joints, I shall reserve for another section.

CHAPTER IV.

DISEASE OF THE ARTICULAR EXTREMITIES OF THE BONES.

Next in frequency to morbid affections of the synovial membrane, and far more serious in character, comes "disease of the articular extremities of the bones." Surgeons have not as yet recognised the full importance of this subject, for very many cases of intractable synovitis proceed from the irritation caused by an unnoticed morbid condition of the adjacent osseous structures. Thus a sudden fall may, in an unhealthy subject, bruise the cancellous tissue at the head of the tibia; the periosteum becomes tender, and irritation is propagated to the synovial membrane, which becomes inflamed and distended by secretion. Rest will relieve the symptoms and give the absorbents time to remove the fluid. The case is called one of synovitis, but its cause is deeper-seated.

We read that in the statistical report from St. Bartholomew's Hospital for the year 1864, there were 86 cases of synovitis, with a percentage of deaths to mortality of all causes of 0·46. During the same period there were 74 cases of "diseases of joints," with a percentage of deaths of 5·06.

This difference in the death-rate leads us to consider the changes which may affect the articular extremities of the bones and extend their influence to the adjacent cartilage and tendons. When the cancellous tissue of a bone has been bruised or otherwise injured, it becomes morbidly vascular. The immediate effect of this is a loosening of the articular cartilage; the surface of the bone becoming preternaturally red and rough, but covered by a layer of vascular granulations of extreme sensibility. I have met with cases in which the disease has been regarded as one of synovitis, and in which, after amputation of the limb, the joint has appeared natural; but on closer inspection there has been found partial detachment of the articular cartilage from the bone, accompanied by all its painful and distressing symptoms. Now, when cancellous bone is inflamed, it throws off the cartilage and its surface becomes ulcerated. This ulceration may be superficial or deep-seated, and we call attention to the first. The shedding of the cartilage is not of itself an irreparable damage. Superficial ulceration may heal, as has often been shown. The exposed surface of the bones becomes covered thickly with lymph, and this passes into fibrous membrane. It often happens that a partially detached piece of cartilage retains adherence by its circumference.

In the case of the femur, nearly the whole head may be destroyed by ulceration, the uneven rough surface which is left being covered by false membrane; or a portion of bone may be detached. In Ser. II. (No. 18), Museum, St. Bartholomew's Hospital, both the acetabulum and the whole of the head and neck of the femur have been destroyed by ulceration. But in these cases the ulcerated surfaces of the bones become finally adapted to one another, so that a very fair cure results.

In this form of disease we occasionally find that irritation is set up by the deposit of tubercle. In Ser. II. (No. 138), the cells of the cancellous tissue of the articular ends and of the adjacent parts of the shaft are filled by tuberculous matter. No change is observed in the attachment of the articular cartilage until inflammation is excited, and then the separation becomes immediate and the symptoms are intractable.

In some cases the diseased bone is not softened, but has a yellow colour from a peculiar firm deposit in the cancellous tissue. Ulceration takes place on the exterior of the diseased bone, and the epiphyses may, in young subjects, be separated from the shafts.

Inflammation may pass into suppuration, in which case we find the matter either diffused or circumscribed. In Ser. I. (No. 47), the substance of the femur has undergone no further alteration than the secretion of pus into it and an increase of its vascularity. In Ser. I. (No. 82), there is a cavity, probably a chronic abscess, in the articular end of the lower part of the tibia. This cavity is lined by a soft and vascular membrane, a line in thickness, and it contained a serous fluid. There is a small aperture in one side of the cavity which penetrates the wall of the bone; but, with this exception, the bone around the cavity appears healthy and the joint is not implicated. But the abscess may burst into the joint. The layers of bone intervening between the cavity of the abscess and that of the joint may become so dense as to lose their vitality and to perish. These portions of necrosed bone separate, a communication is established between the two cavities, attended with great aggravation of the symptoms. The limb is, in most cases, amputated, when the structures are found thoroughly broken up.

An abscess in the cancellous tissue of the bone may cause great amount of pain and constitutional disturbance. In April, 1865, I excised the knee-joint of a young girl, aged seventeen, in consequence of the severe pain which she had undergone for a period of two years. The great cause of suffering appeared to have been an abscess, about the size of a nut, in the extremity of the femur, for the general structures of the knee were in a process of repair. This abscess, imbedded in the cancellous tissue, was a constant source of deep-seated pain. She obtained ease when the limb was in perfect rest, but exercise caused an immediate return of the symptoms. After a sudden twist of the limb, the pain became so severe that she desired the performance of an operation. Inasmuch as the growth of the limb was perfect, the general health good, and the immediate symptoms were referable to an accident, I excised the joint. The convalescence was protracted, but the patient ultimately recovered with a moderately useful limb.

Mr. Lawrence brought to the Hospital, December 2nd, 1846, the leg of a gentleman amputated some hours previously, concerning which he gave the following particulars. The patient had for a long time suffered severe pain in the limb, followed, at the expiration of four months, by suppuration in the joint. The pus was let out by a puncture, and proved to be extremely fœtid. Severe constitutional symptoms supervened, which led to removal of the limb.

We found, on examination, two fistulous openings in the inner part of the limb, leading to denuded and to dead bone, and it was stated that portions of dead bone had from time to time been discharged thence. In the interior of the joint the semilunar cartilages had been disorganised, and the synovial membrane in great part destroyed. On making a vertical section of the head of the tibia, a mass of necrosed cancellous structure was exposed.

The case was one of bruising and of injury to the head of the tibia. The pain, at first slight and transient, had been neglected; temporary relief had been followed by injudicious exercise; until finally the cancellous tissue perished, when inflammation of the surrounding soft structures supervened.

In February, 1865, a young man was under my care in St. Bartholomew's Hospital for general enlargement of the lower two-thirds of the left femur; an immovable condition of the corresponding knee, which was fixed in the semiflexed position; general thickening and matting together of the surrounding soft structures, which were permeated by one or two sinuses leading to denuded bone. We could obtain no very satisfactory account of the disease: the patient had been accustomed to break-in young horses, and, as a rough-rider, had pressed the limb much in "keeping his seat." The swelling had been gradually increasing, and at the commencement had given him pain; but he was easy while in bed. I amputated the limb March 5th. No unfavourable symptom supervened, and the patient recovered. On examining the limb we found that a portion of the shaft of the femur was dead, and incased in a thick shell of new bone occupying the lower two-thirds of the femur. The knee-joint was destroyed, and the tibia and femur united by close fibrous adhesions, and the cartilages had disappeared.

An abscess near a joint is always an object of suspicion. In 1852 I opened a large collection of matter near the coracoid process : it proved a sign of disease in the corresponding shoulder-joint. In 1854 I opened an abscess in the front of the thigh of a clergyman: this was but the indication of more extensive disease of the hip-joint. So abscess of the ham often proves the harbinger of disease of the knee. A boy, aged fifteen, suffered from disease of the knee for two months, commencing, apparently, in the areolar tissue of the ham and extending thence into the joint. During the last fortnight of its progress the pain was excessive. The limb was amputated, and the patient recovered. On examination of the morbid parts, it was found that the synovial membrane was slightly thickened and increased in vascularity. There was absorption of the articular cartilage by its deep or attached surface, so that its connexion with the bone was loosened. The exposed surface of the bones was very vascular.

In Ser. II., Sub-series B., Museum of St. Bartholomew's Hospital, No. 25, we have the bones of the knee-joint of a young person, in which there is necrosis of part of the shaft of the femur, with ulceration of the cancellous texture extending through the epiphysis to the articular surface.

Just as suppuration may be diffused or circumscribed, so may we meet with limited and general necrosis. A small piece of bone may die and become detached; but larger portions especially affecting the cancellous tissue may die and be only partially detached, or still retain adhesion to living structures. In Ser. I. (No. 268) there is a section of the upper part of a tibia, in which portions of the cancellous tissue have suffered necrosis and are partially separated. Lymph and pus are diffused upon and within the dead portions of bone; the medullary canal contains them alone, the rest of its osseous and fatty tissue being removed. The walls of the tibia are thickened and penetrated by several apertures into the medullary tube. The disease is limited to the shaft of the tibia; its head is healthy. The disease had existed twenty years.

The attempts at removal of soddened and dead cancellous tissue while still adherent to the surrounding tissues, is an operation which often fails from the same cause that entails failure to the operation of extirpation of the head of a bone in a case of strumous disease of a joint, namely, the inability to determine the exact limit of the disease. Portions of dead bone may be left, when the irritation will continue until they have separated by the usual process of exfoliation. I have in my possession a preparation of the head of the tibia, in which the cancellous tissue has been greatly diseased. Some of it was removed by the late Mr. Stanley, but the limb became swollen, the discharge profuse and fœtid, and the knee-joint was involved. Amputation was performed; and, on examining the limb afterwards, we found that a considerable quantity of dead bone, which was in process of detachment, had been left. It seemed, in fact, to form the circumference of the bony cyst. A soft vascular substance was found between it and the living bone.

Ulcerated bone admits of repair. In the Museum of the Hospital we have, among other specimens, one showing (Sub-series B., No. 5) the bones of the hip-joint, in which the head of the femur rests partly in the acetabulum and partly upon the ilium, and in this situation has become firmly and smoothly united by bone. In another (Sub-series B., No. 6), a thin band of bone, half an inch wide, is extended between the trochanter major and the upper part of the tuberosity of the ischium.

Complete bony union occurs after rheumatic disease, or in strumous cases, after the patient has outgrown that "diathesis." The repair in a true strumous case is either by fibrous tissue or by bone which is soft, light, and friable. In one specimen (Sub-series B., No. 8) the ulcerated surfaces appear to have healed.

Suppurations often contain pieces of dead bone; and the escape of the contents of the abscess into the joint usually involves the loss of the limb.

In young subjects we meet with separation of the epiphysis from the shaft. In one case disease of the hip had attacked a child, seven years of age, for six months. There was pain, and obscure signs of disease about the hip. Suddenly she was seized with the most acute pain in the joint, which after some time remitted, but returned at intervals. Two months afterwards she died. On examination it was found that the ligamentum teres, the cartilage of the acetabulum, and a part of the substance uniting the three component bones of the os innominatum, had been destroyed by ulceration. There was an opening through the floor of the acetabulum into the pelvis, where a collection of matter was formed beneath the obturator muscle and the fascia. The acetabulum and the capsular ligaments were lined by lymph, which was mingled with pus. The head of the femur was healthy.

Disease of the Articular Cartilage.—Experiments on animals made by laying open a joint and wounding the articular cartilage by the knife, hot iron, or chemical re-agents, seem to show that the injured structure exhibits a strong tendency to heal by the formation of a thick fibrous membrane or a thin bony plate, and that the morbid action does not extend further into the healthy cartilage than is necessary for the completion of the fibrous cicatrix. These facts have greatly modified our views concerning "disease of articular-cartilage," more precise pathological inquiry proving that the so-called "ulceration" is, in truth, the shedding of cartilage from the extremity of an inflamed bone; cartilage does not admit structurely of inflammation, but it is affected by the laws governing nutrition, and is subject to a peculiar chronic change, namely, fibrous degeneration.

Hypertrophy has been noticed under a few circumstances. The cartilage becomes usually pulpy, soft, and elastic. Gurlt says that the microscopical examination is not easy, the parts being separated with difficulty. The hyaline substance is dark, granular, and fibrous; the cells are enlarged, and there are a number of smaller cells and corpuscles; while the whole dark fibrous mass contains in many places corpuscles which appear to have come from the bursting of larger or mother-cells.*

Mr. Wormald, very many years ago, examined the body of a man in whom the right lower extremity, affected by the paralysis of infancy, had not grown at an equal rate with the opposite limb. Among other provisions for equalizing the length, nature had thickened the articular cartilages of the knee-joint. Both on the tibia and on the femur the cartilage was thick, fibrous, soft, and elastic; the lateral ligaments equally elongated.

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* 'Beiträge z. vergleich. pathol. Anat. d. Gelenkkrankheiten,' p. 5, 1853.

Atrophy of Cartilage is very common in old persons, or even in the young who have been long bedridden. It affects either the entire surface where the edges become thin and transparent, or it confines itself to particular spots where perhaps the pressure and friction in progression is greatest. In some cases the removed cartilage is replaced by a white fibrous cicatrix, that portion which remains still adhering firmly to the bone. Thinning of the cartilage has been noticed in gouty subjects, probably from disuse of the limb. In the Museum of St. Bartholomew's there is "an os calcis and astragalus, the articular surfaces of which are uniformly covered by thin deposit of white earthy matter, consisting principally of carbonate of lime, the cartilages themselves being thin." (Ser. II., No. 10.) Also, "parts of the ulnæ of an old woman." (Ser. II., No. 47). An exactly similar portion of the articular cartilage of each ulna has been absorbed; and the space thus left on the surface of each is filled by a vascular growth, like a process of the synovial membrane. This specimen has been described by Mr. Paget as an illustration of symmetrical disease.*

We meet with instances of thinning of cartilage in joints which, after prolonged disease of sub-acute character, have become anchylosed, the opposed surfaces being united by fibrous tissue; and in these cases the attachment to the bone is often loosened, so that, in the event of such a joint being "forcibly extended" by the surgeon, much damage is done by the detachment and laceration of the cartilage. In cases of non-reduced dislocations, the cartilage becomes at first thinned, and, finally, in great part removed, its place being supplied by dense fibrous tissue. In these examples, however, the bone is healthy.

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* 'Medico-Chirurgical Transactions,' vol. xxv. Pl. II.

I have examined many specimens microscopically of cartilage in a state of fibrous degeneration. It first becomes thick, villous, and irregular on the surface. The cartilage-cells enlarge, and the nuclei becomes multiplied and filled with granular matter. Then the cells burst, the nuclei escape, and arrange themselves in linear series; their external contour becomes faint, yet thick, and ready to fuse with that of adjacent nuclei; hence results a pale flat fibre in which marks of nucleus-wall are still visible; the granular matter becomes free. The morbid changes in cartilage have, however, been thoroughly investigated by Mr. Goodsir, to whose works I refer the reader.

In cases of rheumatic disease the head of a bone often becomes surrounded by osteophytes, which may be knotty or lamellated, dense, or light and friable; sometimes they are found loose in the joint. The head of the bone may become atrophied. Of this, the best example is in cases of infantile paralysis, when the bone drops easily from the socket; but atrophy may ensue from long-standing disease, or from advanced old age. These changes more properly belong to "diseases of bone." The cartilage suffers likewise.

The changes which exert an important influence in the progress of disease of the joint are—1, inflammatory congestion of the articular head, with softening and separation of the articular cartilage; 2, ulceration, superficial or deep; 3, suppuration; 4, necrosis; to which may be added the soddened condition of the cancellous tissue, in which state it dies, but does not separate. The bone is useless to support the weight of the body; the parts around are swollen and tender, suppurations form, which burst, and leave sinuses leading to the seat of disease.

Ulceration of cartilage; granular degeneration: are terms applied to a morbid condition of more than usual interest, inasmuch as it involves, sooner or later, the structures composing the entire joint, is attended with intense pain, and not uncommonly leads to the removal of the limb. To Professor Redfern is due the merit of having elucidated the pathological changes of this affection of cartilage. They consist in "granular disintegration." The cartilage-cells become enlarged and full of granules, the nuclei disappearing; and this enlargement goes on until the cells burst and discharge their contents into the hyaline substance. Thus cavities of various sizes are formed, which increase in size and number until nothing but granular matter remains. The hyaline substance undergoes absorption, offering no obstacle to the disintegration of the cells; but in some instances it seems to assume in parts a fringed or villous appearance. These changes may commence on the free surface of the cartilage, or on that surface attached to the bone. In the latter instance, portions of the cartilage may be thrown off or exfoliated in the joint, leaving the surface of the bone denuded.

These changes express disturbance of the nutrition of the cartilage, and lead us to extend our observations to the state of the parts whence it derives its nourishment. The blood-vessels at the base of the cartilage, or its attachment to the bone, form loops which, through the agency of the cartilage-cells, yield the proper supply of nutritive material. The mode of nutrition has been well described by Dr. Sharpey and others. In the healthy state, after the period of fœtal life, no blood-vessels penetrate the articular cartilage. Whatever nutrient fluid they require seems to be derived from the vessels of adjoining textures, especially the bone, and to be conveyed through the tissue by imbibition. In the embryo a layer of vessels is prolonged some way over the surface, underneath the synovial membrane ; but as development proceeds, these sub-synovial vessels retire towards the circumference of the cartilage, and eventually form a narrow vascular border around it, which has been named the circus articuli vasculosus. When the tissue exists in thicker masses, as in the cartilages of the ribs, canals are excavated in its substance, but these canals are few and wide apart.* In the fœtal state the cartilage is perforated by canals, which are looped, and contain blood-vessels. Morbid changes in the cartilage are not necessarily attended by pain of severe character; but where the disintegration goes on at its deep or attached surface, it is associated with an inflammatory disturbance of the articular head of the bone. Then the cartilage becomes loosened by the action of a layer of vascular, highly-sensitive granulations, which push the cartilage in flakes into the joint. It is these granulations which, when pressed by a sudden jar of the limb, give rise to the intense suffering of which patients in this disease so bitterly complain. The limb, during the day, is held by muscular contraction in the flexed position, that being the one in which the ligaments are relaxed, and the pressure of the opposed bony surfaces the least; but should the patient drop off for a moment to sleep, the muscles become relaxed, a slight movement of the limb ensues, the granulations are compressed, and with a violent plunge of pain the patient starts up awake. It is obvious that the practice of straightening a limb thus diseased is faulty in principle, and calculated to aggravate the suffering. By so doing the surgeon presses together and bruises highly sensitive parts, and renders permanent that pain which was previously temporary and uncertain.

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* Quain and Sharpey's 'Anatom.,' vol. i. p. cxxiv. 1848.

The expression, "ulceration of cartilage," as meaning a particular disease, is becoming, on many grounds, abolished. We include such cases under the head of "Inflammation of the Joint;" the inflammation involving the head of the bone and all the tissues proper to the articulation. And when such symptoms arise, as were once supposed to indicate ulceration of the articular cartilage, we know that a layer of these highly-sensitive granulations have sprung from the surface of the inflamed cancellous head of the bone, and that they are actively engaged in removing the articular cartilage from its attachment; but not as a progressively destructive process. The removal of the cartilage is but the step to fibrous union of the ends of the bone, and the completion of a cure by anchylosis. The importance of maintaining rest in these cases is obvious.

Fibrous degeneration of the articular cartilage consists in the splitting of its substance from its free surface into parallel filaments or threads; and microscopic investigation shows that the cartilage-cells first become enlarged and scattered irregularly through the hyaline substance, being five or six times their normal size and containing a mass of nucleated corpuscles. At the edge of the ulcerated cartilage the cellular contents of the enlarged cartilage corpuscles or cells communicate with the diseased membrane by openings more or less extended. When the disease is acute, the cartilage is removed by the bursting of the cells, the escape of their contents, and the rapid absorption by pressure of the intercellular or hyaline substance. But in more chronic cases this substance splits into fine threads, and acquires the aspect of velvet. Scattered among them are found soft masses, which seem to be the discharged contents of the cells. The fibres ultimately become worn away and leave the bone denuded, in which case it acquires a polished aspect and ivory-like hardness, often marked by furrows corresponding with the axis of movement in the limb. Those who wish to investigate these morbid changes more minutely may refer to Mr. Goodsir's well-known pamphlet on the subject. Sometimes the cartilage itself becomes ossified, the whole acquiring the consistence of porcelain. This change has been particularly described by Mr. W. Adams, in a communication to the Pathological Society.

Ossification of Cartilage is more particularly a consequence of gouty or of chronic rheumatic disease. It exhibits itself under two forms. First, as simple ossification, the Haversian canals being filled with earthy salts and the surface presenting a smooth polished aspect of ivory-like hardness; secondly, as a growth of cartilage preceding its ossification, in which case the head of the bone is enlarged, and a vertical section displays a light-coloured line, marking the original and normal surface. In the first variety, according to Meyer,* the ossifying process begins at the line of attachment of the cartilage to the bone, and spreads thence to the free surface, reaching it first in detached points, which after a time become confluent. Or the spots to which the ossifying process reaches do not become elevated above the level of the cartilage, but form an even and continuous surface, the intervening spots of cartilage undergoing fibrous degeneration. The second form of ossification of cartilage is characterised by a growth of cartilage, as in the ossifying temporary cartilage of the fœtus. This process, however, does not extend equally over the surface, but is limited to parts, and thus gives an irregular mulberry aspect to the bone. It either interferes with all movements of the limb, or at least renders them irregular and subject to jerks. These changes are especially frequent in the hip. The first change is the production of numerous small elastic elevations. If we cut them through, we find that they are covered by a thin layer of cartilage, continuous with that of the joint. The interior is a jelly-like substance, which rests on the bone. The microscopical examination of the jelly-like substance shows a transparent faintly fibrous mass, containing a large quantity of "mother cells," of 0·026 to 0·056 inch diameter.

But there are other specimens which seem to prove the existence of a general hypertrophy and ossification of the cartilage, the normal form of the bone being preserved.

Loose Cartilages in joints vary in size from a millet-seed to a large bean or a half-crown piece. In shape they are oval or flattened: on the surface they are smooth, being covered by epithelium, and they have mostly the remains of a pedicle. Multitudes of these growths may in some cases be seen, by the aid of the microscope, proceeding from the synovial fringes. The idea that they are formed by the organisation of fibrinous coagula (Rokitansky) is without foundation. Mr. Rainey has described in them true bone lacunæ, but there is often in addition calcareous deposit.

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* Henle und Pfeuffer's 'Zeitschrift für rat. Medezin.' Neue Folge. Band 1. 1851. § 85.

On February 4th, 1865, I removed one, the size of a florin piece, from the right knee of a boy, aged seventeen. The inconvenience and pain were so great that he solicited the operation. I made, having first transfixed the loose cartilage with a needle, a semilunar incision into the joint, dividing the tendinous structures over the outer side of the head of the tibia. The cavity of the joint was soon reached and opened, and the loose cartilage was extracted by means of double-hooked forceps. I closed the wound with strips of adhesive plaster, put the limb upon a bent splint, and kept the patient quiet for a week. At the end of that time the wound was in greater part united. He finally left the hospital well.

A subcutaneous operation, performed by passing a long thin knife under the integument at some inches distance from the joint, opening the capsule and squeezing the loose body into the surrounding areolar tissue before its complete extraction would, in this case, have been inadvisable, the body to be extracted being so large. And even in the case of bodies of smaller size the operation may be inconvenient, inducing a state of chronic inflammation extending over many years, and involving ulceration of the skin.

According to M. Larrey—who refers to 167 published cases of removal of loose cartilages by operation —out of 121 cases in which the old or direct method was employed, 98 were successful, 5 doubtful, and 28 died; whilst of 39 indirect operations, 19 were successful, 15 failed, and 5 died. From this it would appear, as M. Larrey states, that extraction by either method is attended with decided danger; but that in the *direct* operation the risk is greater to life than in the *subcutaneous*; while on the other hand, in the subcutaneous operation there is increased difficulty, and consequently less chance of success. On account of the difficulty of getting the cartilage out of the joint into the cellular tissue without an undesirable amount of manipulation, Mr. Syme recommends another method, by which, he says, he generally succeeds without risk. This consists in making a free subcutaneous incision through the synovial membrane and cartilage, and applying a blister over the part where it is retained. *

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* 'Holmes' Syst. of Surg.' vol. iii. p. 739.

CHAPTER V.

TREATMENT.

The first and most important principle of treatment in inflammatory diseases of joints is the imposition of perfect rest. "Although," remarks Mr. Hilton, "it is, I believe, impossible to explain what are the profoundly delicate elaborations which are appended to, and associated with, repair and growth (those marvellous renewals of life and strength resulting from repose and rest), I need not insist upon their obviously beneficial and constant ministration to the exigencies, emergencies, and necessities of man's life upon earth. Although it is impossible to explain how those myriads of agents of inconceivable minuteness carry on their recondite labours, we nevertheless know that they are stimulated by forces whose exquisite balance is very easily disturbed. Practically, the maximum of result is co-equal with the minimum of disturbance. Thus, rest becomes the great fosterer of repair. It is equally impossible to deny the manifestation of this influence of rest, whether we search for it in the seat of man's highest intellectual faculties, or in the vital endowments of a simple tube forming a blood-vessel."* To this rule there are very few exceptions.

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* 'On the Influence of Rest,' p. 8.

In all diseases, however, whether acute or chronic, we may lay down simple directions whether joints should be kept at rest or exercised, and also the kind of rest or of exercise that we should impose. "When the malady is the result either of excess or of want of exercise, proper movements constitute a fundamental part of the treatment. Thus, when an immobility, prolonged for many months, is the cause of articular stiffness, and perhaps of lesions (as is seen, for example, as a consequence of the treatment of fractures), exercise of proper movements will be the essential and nearly the only means of cure; but in cases of disease, whether acute or chronic, movements for the most part only aggravate the symptoms."

Treatment by Rest.—That a joint should be at rest requires, first, that the bones be in such a position that their surfaces do not press against one another; secondly, that this position be maintained continuously. A patient should not be made to sit up daily to have his bed made, nor to limp to the water-closet. The movements inseparably connected with such proceedings may do in one day more harm than the consecutive rest can repair in a week.

Rest in bed realises only a part, but yet a very important part, of the conditions to be fulfilled. We should endeavour to guard against the possibility of any incautious or sudden movement, such as spasmodic muscular contractions during sleep. In order to effect this purpose, splints, bent, or capable of being bent at various angles, have been introduced, and attached to the limb by means of rollers or straps and buckles.

In acute disease it rarely happens that patients can bear the necessary amount of pressure. An apparatus or splint to be effective must be bound tightly to the limb. None answer this purpose better than a padded tinned-iron splint capable of being bent by the surgeon. The whole limb is first enveloped in a roller from the extremity upwards towards the trunk; then, with the reverse of the roller, the splint is fixed firmly in its place. But, as already stated, this cannot always be borne; we are then obliged to trust to narcotics, administered either by the mouth or hypodermically: one-quarter to one-half a grain of acetate of morphine may be injected under the integument of the joint with great advantage to the patient.

Direct, moderate, and equal pressure, by means of a roller applied along the whole length of the limb, is often of service. It prevents œdema, and supports parts weakened by inflammatory exudation; but it is fitted only for chronic cases. The bandage may be steeped in starch or dextrine, or we may employ a case moulded to the limb, of gutta-percha, of leather, or of pieces of calico united by a mixture of white of egg and flour, or of gum and chalk, &c. The surgeon should know how to make these cases; and yet how few are conversant with all the details of the proceeding! A gutta-percha case is thus made. Everything must be prepared and at hand. A piece of moistened lint applied to the limb, and cut into shape, will give the exact size of the gutta-percha necessary for use, and a piece of corresponding proportions must be accordingly prepared. The gutta-percha cuts the more easily when the knife, which should be sharp, is entered obliquely. There must be at hand a shallow tin dish, a can of boiling water, a piece of lint, a pair of forceps, a towel, and a roller.

The lint is first put on the part to be covered by the gutta-percha splint, so that the heat may not be unpleasant to the patient. Next, the tin dish is filled with boiling, or just boiling water; the gutta-percha is immersed until it seems to be on the point of becoming almost semifluid; it is then taken from the water by the aid perhaps of the forceps; it is lightly pressed between the folded towel, thrown on the limb, and firmly fixed by the fold of the roller. The whole process must be completed in a very few seconds. The error consists in the application of the gutta-percha while it is yet too firm; in which case it never fits the limb well. If it does not fit the limb to a nicety, it has no power in checking that spasmodic movement which is so distressing to the patient. The usual fault is, that the water in which the gutta-percha is immersed is not sufficiently hot. It should be just below boiling-point.

The splint of eggs and flour is thus made. The limb to be supported is covered either in its right or left half by moistened lint, in a single piece cut into proper shape. The white of egg and flour are mixed to form a thick paste. Pieces of calico-roller are dipped into this mixture and laid upon the lint, first longitudinally, then transversely, and, thirdly, again longitudinally. Three layers usually suffice. About six to eight hours must elapse before the splint is sufficiently hard to admit of removal, when it is found accurately moulded to the limb, the edges a little rough and requiring cutting. A second splint may then be formed for the opposite side, if necessary; and finally, both are to be bound on by a starched roller. To this the only objection is the time and trouble; but the splint is superior to any other of similar character.

The gum and chalk bandage is prepared by rubbing the two together with water so as to form a thick creamy fluid. This fluid is then applied to a roller or piece of linen cloth, in which the part has been previously invested. It hardens in about five hours; but warm water softens it again, hence it is not suitable to all cases.

The plaster of Paris bandage is thus made. "A roller, which should be of coarse and open material, must be previously prepared by rubbing into its texture dry powder of plaster of Paris. The surgeon should have at hand a bag of the same material and a basin of water. The limb being protected by a layer of cotton wool, the prepared roller should be immersed in water for about a minute; it is then ready for immediate application. It should be rolled around the limb in a spiral manner, just as an ordinary bandage; after every second or third turn of the roller the left hand should be plunged into water and smeared over the part last applied. When the whole has been thus treated, the exterior of the bandage should be rubbed over with a paste of plaster of Paris and water until a smooth surface and sufficient rigidity have been attained. This form of application, after the lapse of ten minutes or a quarter of an hour, will have acquired its permanent condition of rigidity."* Care must be taken to watch a limb subjected to such pressure. I was once called upon to amputate a limb in which all the structures mortified down to the bones in consequence of the bandage being over-tight.

Pasteboard and leather splints are made by soaking the material in warm water, and bandaging it on the limb. All applications which entirely encircle a limb are mostly inadvisable in the class of cases now under consideration. We should hold a diseased joint firm, but leave at least some part open to which proper remedies may be applied. A very useful preparation has been lately introduced by Mr. Hydes. Most of these directions are better suited for the construction of apparatus necessary for the treatment of chronic cases. In the acuter forms of disease we must trust more to general measures.

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* T. Smith in 'Holmes' Surgery,' vol. iii. p. 9.

For a moment, suppose that we have to treat a case of inflamed synovial membrane in the knee-joint. Rest in bed takes off all pressure; semiflexure of the limb removes the direct apposition of the diseased surfaces; an opiate relieves immediate symptoms. Here are combined the conditions essential to recovery. Put the patient into the country, and administer tonics and good food, and in most instances the recovery is expedited. But when the patient again uses the limb, the bone may be unfit to support the weight of the body; it becomes soddened, bruised, and painful, or infiltrated by pus, and again the patient has to rest until this morbid condition has subsided. The recurrence of these attacks of supposed synovitis, but, in truth, of disease of the bone, lead in many cases ultimately to changes requiring the removal of the limb. Hence, the period of convalescence should be carefully watched and prolonged.

The effects of continued exercise on a limb in which the component parts of a joint were in a state of disease, were well exemplified in the case of a female, aged forty, on whom Mr. Lawrence performed the operation of amputation of the thigh for disease of the knee, Dec. 21,

1864. The lower third of the femur was in a state of vascular congestion; the layers of the bone were separated; some of the bone was dead; a layer of new bone had been deposited under the periosteum, around the old bone; and in the articular extremity was a small abscess about the size of a small nut. In this case inflammation had extended beyond the cancellous texture of the epiphysis, and involved the lower third of the shaft, constituting one form of the disease known by the name of osteo-myelitis, which has been witnessed so frequently in the stumps of limbs amputated for gunshot injuries or railway accidents.

Whatever may be the joint, let us, if we wish to preserve the patient's limb, avoid the practice of "forcibly setting it *right*," as is so called, at once, *even if the inflammation be acute.* It is assumed that in unnatural positions the different parts of the joint are kept in a state of undue pressure or of undue tension, either of which interferes with healthy nutrition and so opposes the curative process. But the flexed positions of the thigh, the knee, the shoulder, or elbow, are the easy positions into which the respective limbs are thrown in sleep. To extend them is to put all parts in a state of tension, which cannot be long borne by the strongest, and which must certainly tend to aggravate symptoms. Imagine a surgeon forcing straight a knee-joint or hip-joint in a state of disease, and strapping it down to a splint of sufficient length. Let him consult the Brothers Weber on the anatomy of the joints, and learn how by such a measure he would press together joints morbidly sensitive to pain. Well may orthopœdic institutions flourish when such a practice can find favour in the eyes of general surgeons.

The extension of a limb should never be attempted until all progressive morbid action has ceased.

Although passive movements of a limb are quite inapplicable in all cases of active disease, yet in some forms of chronic disease they may be of service. Thus, in rheumatic affections, they finally give to a patient some amount of flexion and extension, although this may be attained by the surface of the bone, denuded of its cartilage, becoming worn into defined grooves or furrows.

Again, passive movements may be practised in cases where external thickening of a joint impedes the proper use of the limb. In these respects the line of demarcation between the anatomical and physiological treatment cannot be clearly defined. In many cases the bones are flexed and displaced; in others the limb is only flexed. In the former we can have but little hope of restoring free motion; but yet pressure, well directed, may accomplish more than at first seems possible. This is especially the case in such a joint as the knee, where the articular surfaces are flat.

Bleeding.—No one, who remembers the practice of the last thirty years, can fail to be struck with the change of opinion which has taken place among practitioners with reference to the subject of blood-letting. The use of the lancet, or the repeated applications of the cupping-glass or of leeches to an inflamed joint, has gone into disuse, and we perhaps err on the other side. But, doubtless, juster views of pathology have shown that in by far the greater number of cases of disease the nutrition of the component parts of the joint is incomplete: the bone is too soft, the synovial membrane too readily affected by cold or other external agencies;

or, in the case of individuals apparently in rude health, that there is some morbid element in excess in the blood, as is illustrated by the phases of gout or rheumatism. We are no longer content with simple abstraction of blood. In strumous diseases an opposite line of treatment is indicated. In rheumatic and gouty cases we avail ourselves of such remedies as are known to act chemically upon the morbid product, or are supposed to possess some specific virtue, such as lemon-juice, bicarbonate of potash, colchicum, iodide of potassium, &c. From these remarks we except wounds of joints.

As a specimen of the method of treatment thirty years ago, I will relate from very accurate notes the following case. A pallid and overworked girl, Martha F——, a needlewoman, aged seventeen, consulted a surgeon of eminence, March 15th, 1840, in consequence of inflammation of the right elbow-joint, attended by considerable swelling and pain. It was said that she had received a blow two days previously. Eighteen leeches were applied, a linseed-poultice, a dose of senna mixture were ordered, and low diet was imposed. On the 17th, twelve more leeches were applied, and saline mixture, with half a drachm of the solution of the potassiotartrate of antimony, was ordered three times a day. On the 18th, twelve more leeches were applied, and, as she could not sleep, five grains of soap and opium pill were ordered at night-time. On the 26th a blister was applied. On the 2nd of April there was renewal of pain, and twelve more leeches were applied. On April 4th another blister. On the 18th eighteen more leeches were applied. Mercury and chalk were given in doses of two and a half grains every six hours; twenty minims of tincture of opium at night-time. On the 26th an abscess formed near the inner condyle; a free incision was made, and two days after a second opening was made between the olecranon and outer condyle. After this, six ounces of port wine were ordered daily; good diet; but the night perspirations were very profuse. On the 19th, another large abscess was formed near the one first opened; an incision was made, and a large quantity of pus escaped. On June 20th she was discharged with a stiff joint. Now, the lowest computation of the amount of blood abstracted by a leech is one drachm; another drachm is supposed to be lost by subsequent fomentation. This is, however, much below the standard. Assuming, however, this low average to be correct, we have an overworked, underfed, and underpaid girl of seventeen subject to a loss of blood amounting to thirty-six ounces in about as many days; besides which, the diet was restricted, and she suffered from the administration of a solution of tartar emetic in nauseating grain doses. Of course abscesses formed, night sweats supervened, and then, somewhat too late, wine and better diet were ordered, and opium was administered at night-time. Such cases show that, in contrasting the treatment of the present and the past, we need not deem it necessary to speak of the "change in the type of disease."

This was the "hectic" of the older writers,—a condition supposed to be due to disease; but in the greater number of cases the consequence of depletion and of restricted diet in persons of feeble frame.

On the 25th of April in the same year, a young man, aged twenty, was the subject of synovitis of the right knee from cold of one week's duration. He was ordered eighteen leeches and two calomel and jalap pills. On the 29th, eighteen more leeches were applied. On the 1st of May twelve leeches; on the 3rd twelve leeches more. On the 4th eighteen leeches. After this a succession of blisters. He obtained, it is recorded, "partial relief." Thus in nine days seventy-eight leeches were applied, equal to the abstraction of nineteen and a half ounces of blood.

In cases of a wounded joint, I have known the repeated application of leeches, twelve to eighteen at a time, of incalculable benefit, relieving pain and enabling the patient to obtain rest; and the ease thus obtained could not be procured by other means. I have also seen yet severer cases, in which a punctured wound of a joint has been followed by great heat of skin, hard pulse, white and furred tongue, with shiverings; under which circumstances the general abstraction of blood has afforded relief.

Narcotics, administered by the mouth or hypodermically, deserve from their value particular notice. In acute disease the muscles hold the limbs spasmodically fast in that position which is easiest. When sleep supervenes, the muscles become relaxed and the joint is moved, so that the articular surfaces become pressed one against the other, and the patient awakes with a violent "plunge of pain."

In chronic disease a joint overworked or unduly extended aches as night comes on, and the pain in course of time becomes insupportable. The patient cannot rest in bed; he tosses about until morning, when, half-exhausted, he sinks into an unrefreshing sleep.

An opiate of sufficient strength, timely administered, counteracts these unpromising symptoms. For an adult twenty-five to thirty minims of tincture of opium may be given at bed-time, to be repeated; or an hypodermic injection of half a grain to a grain of sulphate of morphine may be applied in the proximity of the joint, or, indeed, elsewhere in any convenient situation.

For hypodermic use, ten grains of acetate of morphia are dissolved, with a little acid, in a drachm of distilled water. Thus every six minims contain one grain of the salt. Three minims—the common amount injected for an adult—represent half a grain. The effect is often very remarkable, as affording to a patient a period of complete relief from pain. It, however, wears off by repetition, and a larger amount has to be injected. In one case I had injected at one time as much as two grains with good effect. In another case, one-half a grain produced symptoms of coma of a dangerous intensity. With some patients this method of administering a narcotic is followed by nausea, sickness, and headache; with others the effect is simple relief from pain. It does not much matter into what part of the body the fluid is injected; the skin of the back of the forearm is often selected, but it may be readily introduced, if thought necessary, in the immediate proximity of the diseased parts.

Thus, in a case of acute inflammation of a joint, we impose absolute rest; we endeavour to rectify any faults of constitution; we abstract blood locally, if necessary; and employ warm or cold applications as may be most agreeable to the feelings of the patient. Among the latter, continuous irrigation is, perhaps, the most efficacious; we endeavour, by prompt treatment, to prevent suppuration in the joint, and by continuous treatment, carried out to the end, to avoid a condition of sub-acute inflammation, terminating in thickening and consolidation of the surrounding tissues.

Respecting the formation of pus in a joint, it may be remarked that there are pus-corpuscles floating in the synovia in most cases of synovitis. These pus-corpuscles become absorbed as the disease subsides. At some no very distant period pathologists will wonder that there should ever have existed a belief in the non-absorbability of pus. The practical rule in all cases is to *avoid opening the joint.*

But there are cases of acute joint-disease in which the articulation is disorganised; the bones throw off their cartilaginous coverings; sequestra have been detached; and the whole cavity is a bag full of pus and general débris of the proper structures. In these cases an incision may be made with advantage. The practice of laying open large joints by a long incision in certain states of disease has been known to surgeons for many years. I have seen the late Mr. Lloyd thus act in a case of strumous disease involving all the tissues of the knee in a youth, and the patient recovered with a stiff joint. Mr. Gay has carried out the practice yet further, having, perhaps, correcter ideas of the "shedding of cartilage" than were formerly entertained. He first freely opened diseased joints in 1851. "At that time," he observes, "the joints were sealed against all interference beyond that which Sir Benjamin Brodie recommended—namely, a simple opening in case of abscess — on pain of destruction to the limb and the chance of death to the patient. I was led," he continues, "to the practice by observing constantly in the interior of joints portions of shed cartilage or of bone, or other débris; and felt assured that, unless they were released by free incision, they would prolong the disease by retarding the natural processes of restoration.

In many cases I found I was right; in others I have been disappointed, as the disease appeared to be in no way affected by the incision. Still, on the whole, the practice is worthy of attention; for even in cases of its not answering, excision or amputation can be as readily performed as if no such step had been taken. The difficulty of the removal of 'shed cartilage' through a narrow sinus is obvious. Incisions are useful," he adds, "in the *earlier* and *later* stages of joint-disease, but not in strumous or tubercular disease. I have several times removed a loose portion of bone from a joint in the later stages, which alone had kept up disease, and in the earlier stages have let out some sero-purulent fluid; in both with the perfect remission of the symptoms of active disease."

The subcutaneous division of tendons and of fibrous bands in cases of contraction is a proceeding often highly beneficial and important, but yet it has been practised somewhat indiscriminately. M. Jules Guérin attaches very great importance to making the superficial puncture at least two-thirds of an inch (*deux centimètres*) from the spot where the deeper structures are divided. The value of this rule has been over-estimated; and in many cases adherence to it would be inconvenient, as, for instance, in cutting the hamstring-tendons. The opening should be as small as possible just over the tendon, and made with a sharp clean knife; and a small pledget of lint should be fixed by a strip of adhesive-plaster the moment the instrument is withdrawn. Whatever is to be done should be completed promptly, and, where possible, by a single movement of the hand. It is better to repeat the operation at a distant period, than to jag and tear the subcutaneous structures. The division of tendons in the case of contracted joints from disease in children is a proceeding rarely necessary, inasmuch as most joints come out by extension.

Few surgeons have performed subcutaneous tenotomy more frequently than myself, and I have met with no evil consequences where the section of the tendon has been effected promptly, and without laceration, in a person of moderately good health, however close the minute puncture of the skin might be to the deeper parts involved in the operation; but in cases of deformity consequent on disease, the difficulty in replacing the bones depends less on the contraction of tendons than on the formation of adhesion, fibrous or osseous, and on alteration in the shape of the articular surfaces of the bones. Such adhesions have to be stretched or ruptured, or sometimes divided by the same process as in the division of tendons. However, most fibrous bands generally yield readily to slow extension.

The combination of artificial movements with the process of slow extension has not found general favour in this country. The two systems are somewhat antagonistic. Extension should be kept up unremittingly night and day. The removal of the apparatus for any other proceeding, or alteration in the degree of pressure, rather retards the progress of the case. I have on several occasions effected the rupture of an osseous band by turning the screw of an extending-apparatus, and have then carefully tried artificial movements of the limb, the patient being under the influence of chloroform; but it may be questionable whether much permanent advantage was gained thereby.

When the leg has been contracted for many years, and has become atrophied and cold, the muscles reduced by fatty degeneration, an artificial limb may be safely recommended; and in some cases amputation is a measure greatly beneficial to the patient.

The following cases show the dangers of forcible extension :—

Oct. 4, 1862.—John C., aged thirty, was admitted into St. Bartholomew's Hospital, suffering from stiffness of the hip and knee-joints of the right side, with adduction of the thigh and flexion of the leg to nearly a right angle, following a severe attack of acute rheumatism. He was pale and emaciated, and had evidently suffered severely. He was ordered nourishing diet and a fair amount of stimulants, and, on the 16th, the thigh was extended and abducted on the pelvis by forcible movements. The usual sound of yielding fibrous tissue was heard, and severe pain, attended with complete loss of sleep, ensued. On the following day the limb was considerably swelled; the pain was so severe that the patient could not bear the pressure of any apparatus or splint. Six leeches were applied to the groin, followed by fomentation; and opium was administered to quiet his restlessness. This state of suffering continued more or less for the space of one fortnight. On the 29th November the knee was forcibly extended on the thigh. Great pain followed the manipulation, but not so severe as in the case of extension of the thigh. I saw him on the 5th of December. The limb was in better position than when he entered the hospital, and especially the adduction of the thigh had been removed, but the limb was still partially bent on the pelvis; the knee still somewhat bent on the thigh, although a long splint had been skilfully applied posteriorly, and as much pressure as the man could bear been steadily kept up. He had not left his bed once since his admission.

Henry H., æt. six, was admitted into the Hospital, Oct. 1, 1863, with contraction and adduction of the left hip, in consequence of disease of two years' standing. The limb had been forcibly extended, and kept attached to a straight outside splint for a period of two months. The pain became so severe that the treatment was discontinued, and he came under my care quite exhausted by suffering. Soothing measures were adopted, and his general condition improved. Dec. 1: he is still in bed, and complains of occasional pain. He left the hospital to stay some time in the country.

In September, 1863, I amputated the thigh of a little boy on whom extension of the knee-joint, forcibly employed, had been followed by the formation of a large abscess under the muscles in front of the thigh, by ulceration of the bone, and shedding of the cartilage. The upper surface of the tibia had become altered in form, and was soft and friable.

A boy, aged twelve, had strumous thickening of the synovial membrane consequent on a fall four years previously. In course of eight months after the accident the leg became semiflexed and fixed. A surgeon who saw him forcibly extended the limb, a proceeding which caused intense pain, lasting for some days. In course of time the limb, thus extended, recontracted, and a second time it was forcibly pulled straight about twelve months after the first operation. He was admitted into St. Bartholomew's Hospital, 9th Dec., 1858, labouring under the following symptoms. The limb was fixed and motionless; the knee-joint was acutely painful either on pressure or attempted flexion. There was general heat and swelling of the limb. He was ordered a few leeches, a poultice, and generous diet, and remained in the hospital until the parts affected got into a quieter state. At the time of his discharge the knee was semiflexed, the tibia and fibula drawn backwards, and rotated outwards; the whole limb was wasted and weak. A gutta-percha splint was applied, and the patient was sent into the country to recover his health.

In 1863 a young woman was under my care, in St. Bartholomew's Hospital, suffering severe pain in the right knee-joint, attended with cramps in the limb at night time. The leg was bent at a right angle on the thigh. I found that some time previously she had been put under the influence of chloroform when the limb had been straightened; the surgeon who performed the feat having informed me that he felt a "grating of bone in the joint" as he moved the leg. Such a proceeding was not advisable, for by so doing he disturbed parts which were undergoing repair; he broke down adhesions, and re-excited morbid action. On the extension being removed, the leg went back to its flexed position. I had a simple apparatus for extension applied, and, by slowly acting on the limb, which was kept perfectly motionless, succeeded in rendering the parts straight without producing pain or suffering to the patient.

It is worthy of remark, that with a large class of practitioners local applications constitute the only, or nearly the only, therapeutical treatment of diseases of joints. Their utility is doubtless great; but we should fail in affording the patient his full measure of relief if we did not endeavour to ascertain with accuracy that peculiar fault of constitution which rendered him prone to such disease, and to employ the special medical treatment required. Thus, for example, a patient now under my care, the conductor of an omnibus, aged twenty-seven, was admitted into the Hospital, June 8, 1865. His disease is chronic arthritis of the left hip; his pain is severe in that articulation, but yet more severe in the corresponding knee; the whole limb is somewhat shrunken. His local symptoms are relieved by rest, by the employment of warm applications, by counter-irritants; but, combined with these, he has taken such medicines as are best calculated to correct his general condition. On similar principles, strumous affections of joints may often be cured by general treatment only.

Warmth and moisture are generally very grateful to a patient's feelings; and no local application accomplishes this so well as a large and well-made poultice. The best is made of linseed-meal and bread in equal proportions. Many patients have assured me that this application has done them more good than anything else. Medicated poultices do not possess any special merit. In cases of offensive and bad-smelling discharge the fetor can be corrected by a poultice of charcoal in powder, and just as much linseed-meal as will make it cohere. The use of warm flannels, of spongeopiline, of hot sand-bags, &c., are different ways of accomplishing the same end. They are not quite so convenient, and possess no claim to superiority. The poultice is essentially a clean application; once used, it is thrown away, and a new one, prepared by fresh materials, is put in its place.

Olive and almond oils, fats, &c., are of no use unless to soften a hard and dry skin, or to remove scabs and other incrustations. They may be employed when friction by the hand is desirable as a form of counter-irritation, but they possess no specific value.

A warm-water bath cannot always be employed: for example, in a case of diseased hip, it would entail too great an amount of movement; but in the case of disease of the elbow, it is practicable, though less convenient than the poultice. In the case of an inflamed wrist and hand, it possesses many advantages. The temperature can be raised to any degree, and maintained so by the addition of boiling water. Thus the flow of blood may be encouraged from local incisions, or from leech-bites, when necessary; and the soothing effect is felt by the patient for many hours.

Among the various remedies in the treatment of chronic cases, the vapour-bath occupies an important position. The Russian bath combines, more than the Turkish bath, the use of the cold douche with the action of vapour. The patient is put into a room, where the temperature is gradually raised to 105°, 115°, 120°, Fahr. He lies on a couch, the head a little higher than the feet. A sponge soaked in cold water, often renewed, is held on his forehead to prevent cerebral congestion. While the body is thus plunged in vapour, an attendant strikes gently the whole surface of the body with a little birch-broom (*balai de bouleau*), and then rubs vigorously, especially on the diseased parts; while the skin is thus excited, a stream of cold water is poured on him from a machine like a large watering-pot. The patient, after having received this cold douche for two or three minutes, retires, well wrapped up, to a couch, where he perspires profusely.

The Turkish bath, now well understood, differs from the above in no important particular.

Bonnet speaks highly of the baths of "vapour douche." They are formed by a jet of vapour proceeding from a vessel containing water in a state of ebullition, and they may be simple or compound. In order to obtain the latter, the vapour is made to pass through vessels containing volatile substances; those which are usually employed are aromatic plants: thyme, sage, rosemary, &c. By means of these "vapour douches" two different effects are produced: first, an emollient action, when the temperature is 85° to 95° Fahr., and they are directed slowly on the diseased part, around which they form a sort of warm bath. They are exciting, on the contrary, when the temperature is raised above that of the body, when they are charged with aromatic principles, and they strike with more or less force the affected portion of the skin. In the first place, they relax the cutaneous envelope, and produce a gentle transpiration; in the second, they determine a more or less bright redness of the skin, and a sanguineous congestion which extends to the deeper parts. The local excitation which they produce may extend to the whole economy: thus they may stimulate the resolution of chronic congestion, or do harm by giving too rapid a progress to swellings which have been irritated and are disposed to suppurate. The records of the Infirmaries of Margate and Seaford, and the improvement which patients undergo in sea-side hospitals, have attracted such general attention as to lead to the formation of convalescent hospitals as part of the establishment of the wealthier hospitals of London. We attach more importance to fresh air than to baths, whether of compressed air, or of hot air, of hot or cold water baths, or of baths of aqueous vapours. But in France there prevails a belief in the importance attached to their temperature, density, and mode of administration. M. Pravaz remarked that all these measures have one common character, namely, to render more active the functional movement of organs, to increase the elimination or the combustion of the materials which compose the economy, and consequently to render organic renovation more rapid.*

The doctrine of the absorption and elimination of certain medical agents—such as iodine, sulphur, the alkaline and earthy salts, such elimination carrying with it noxious elements from the economy—may be true in some cases, such as rheumatism. In scrofula we have no evidence of such a result. In England, until very lately, the act of bathing has been rendered as incommodious and uncomfortable as possible. The hot-water bath was put in a small chamber, the air of which speedily became overloaded with vapour. The vapour-bath was in a chamber rather smaller and less commodious still than the preceding. The discomforts of the bathing-machine by the sea-side still exist. Much has been done to render the two former more attractive. Let us hope that the customs of Biarritz may at last find favour here.

The simple immersion of the body in water can serve no other purpose than that of softening the epidermis and favouring the flow of blood to the skin; but when the patient moves in it, as in the tepid swimming bath, it becomes an excitant; the general circulation of the body is roused, and the skin is warm and perspires freely.

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* 'Essai Médical sur l'Emploi de l'Air comprimé,' Paris, 1850.

It is supposed that a column of water, either hot, or cold, or alternating, directed against any part of the body, fulfils in many ways the conditions of a body moving in the water, and an apparatus has been constructed, composed of tubes and a forcing-pump, by which the stream might be directed to any one point. Such a measure is suitable in cases where it is desired to restore motion by passive exercise to a joint disabled by rheumatism.

The treatment by cold water has been carried out in institutions devoted to that one object. These establishments are always situated in the country, in some salubrious spot, mostly among lofty hills or mountains, where patients enjoy the advantages of air and exercise.

But the direct application of cold has been carefully studied in its effects on diseased tissues by Dr. James Arnott, formerly superintending surgeon at St. Helena; and the rules which he lays down may be perused with advantage, whether we employ cold to check disease, to relieve pain, or to enable us to perform a painless operation.

"The refrigeration or intense cold produced by the mixture of ice with various salts, congeals the fluids in the part to which it is applied, and within certain limits causes a more complete insensibility than chloroform. It is a perfectly safe agent. When congelation was first proposed, the objections made were, that it might destroy the vitality of the tissues; and, if they escaped destruction, that the reaction excited by it would interfere injuriously with the healing of wounds. Experience has shown that both of these objections were unfounded. If the process be properly conducted, the skin is not injured; and, instead of causing detrimental reaction, the healing process is promoted by the congelation preventing that excessive degree of reaction which so often opposes the immediate union of parts." *

If a part be inflamed or very vascular, either the ordinary mixture of ice and salt, or a medicated frigorific, must be applied for a longer time than usual, and it may be necessary to stop or weaken the circulation through the part by pressure.

Applications which alter the Structure of the Skin.—These applications are arranged under three heads: the first, such as blisters, detach the epidermis, and produce a secretion of serum more or less purulent; others, such as croton oil or the ointment of tartar emetic, are followed by a pustular eruption; others, again, destroy the skin to a greater or less depth. The two last are the subjects of present consideration.

The agents which act chemically on the skin are caustic potash, the Vienna paste, chloride of zinc, strong nitric acid, the acid nitrate of mercury. The strongest nitric acid of the London Pharmacopœia contains only 3 per cent. of water. Its fumes are dangerous to those who incautiously inhale it. The action of almost all caustics, which act chemically, is the same, namely, to attract the elements of water, and thus to deprive the tissues of oxygen and hydrogen. A mass of black charred substance is left behind.

The agents which act by heat are the heated iron, moxa or the galvano-cautery. By these means the elements of water are driven away, and again a char only remains.

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* 'Contrib. to Pract. Med.,' p. 6.

Potassa fusa is an application suitable for the production of superficial eschars. Its action is soon exhausted. We destroy by it nævi materni, the ragged edge of a bubo, varicose veins, &c. The Vienna paste and the chloride of zinc act more deeply, both by depriving the tissues of the elements of water and depositing the metal on the surface. The same may be said of nitrate of silver. In practising the "transcurrent cautery," the heated iron is passed rapidly over the joint; the surgeon endeavouring to avoid the complete division of the skin. But as the cauterization produced by this first passage of the iron is insufficient, it is necessary to conform to the practice of the veterinary surgeons. These attach great importance to the heat which results from the employment of the hot iron, and the object of their proceedings is to make the heat penetrate as deeply as possible. They pass, therefore, the heated iron eight or ten times along the same lines, pressing but lightly, so that the skin be not charred in its entire thickness; and they stop only when the course of the iron acquires a golden-yellow hue, or when drops of transparent serum make their appearance. This mode of proceeding is suitable for a joint superficially placed, such as the knee. In the case of the hip, the heat must penetrate further and the eschars be proportionately deeper.

It cannot be denied that there are many cases in which severe pain, uncontrollable by other means, is relieved by the employment of the actual cautery.

If it be desired to protect a joint from cold, as well as to exert some compression and impede its movements, we may strap it with soap-plaster, in broad strips, one inch and a half to two inches wide, and of amply sufficient length to encircle the limb once and a half round. This should be covered with broad pieces of white leather on which some adhesive material has been laid, and the whole covered with starched bandage. But this is suitable for chronic cases only.

The direct application to the skin of the strong mercurial ointment, with camphor, as recommended by the late Mr. Scott, is not applicable in cases where active inflammation may be re-excited. I remember one case in which it seemed to excite active inflammation and suppuration in a joint which previously had been affected with hydrarthrosis only. In more chronic cases, however, it is useful; but it may become a source of irritation, and the same advantages are attained by less irritating substances.

Before proceeding to describe the general application of the above principle of treatment, let me relate the following pathological summary:—

1. The synovial membrane and the articular extremities of the bones are the only structures of those entering into the formation of a joint which are susceptible of primary inflammation.

2. Ligaments and fibrous capsules may become softened by chronic congestion of their vessels, and faulty nutrition. The other structures, such as inter-articular fibro-cartilages, undergo morbid changes from a similar cause.

3. Articular cartilage is not prone to morbid change. The so-called ulceration depends on a morbid condition of the head of the bone. The pain proceeds from the

loosened or detached cartilage resting on a layer of highly sensitive granulation.

4. But there is a "fibrous degeneration" of articular cartilage dependent on changes in the cartilage cells, and faulty nutrition, commencing on the free surface and extending to the bone.

5. Scrofulous disease of a joint usually involves all the tissues. It is a form of "chronic inflammation" in a subject of feeble health. There is nothing in it of a specific character.

6. Fibrous degeneration of the cartilage is usually an accompaniment of chronic rheumatism. When the cartilage has been removed the bone is usually eburnated, and its surface furrowed.

The next indications which we have to fulfil are to restore distorted joints to a proper form, and to re-establish the natural relations of the bones. For this purpose we use extension, manipulation; and in certain cases perform surgical operations.

Extension and manipulation are of use chiefly in cases of recent injury, such as dislocations, respecting which the experiments of Professor Fabri on the dead body show that as a rule the head of the bone is thrown primarily only in one direction from the socket, namely, at that spot where the capsule is weakest, and that the other forms of dislocation are secondary. Thus in the hip, the head of the femur is first thrown on the thyroid foramen, the muscles pulling it secondarily on the dorsum ilii. In the shoulder the head of the humerus is first thrown into the axilla, the muscles pulling it secondarily under the clavicle or coracoid process. The method of reduction consists in manipulating the bone through the course which it has taken to the rent in the capsule, when it is easily jerked into the articular cavity. In cases of dislocation of the hip, I have succeeded in effecting reduction without other hands than mine, and without the aid of ropes and pulleys. In one case, the head of the femur was on the dorsum ilii. The man having been rendered insensible by the administration of chloroform, I bent the thigh on the pelvis, and worked the head of the bone to the thyroid foramen; a slight rotatory movement of the limb easily completed its reduction. The end of the case was interesting. The man had been a hard drinker, and had had for some years obscure signs of cerebral mischief. During the administration of the chloroform he had a paralytic seizure, from which he never recovered, but died seven weeks afterwards in St. Bartholomew's Hospital. There was found, on examination, softening of the right cerebral hemisphere, which was reduced to an ashy-grey substance. The head of the femur was in its normal position, but the laceration of the capsule was at its inner side, and the lacerated tract among the glutei muscles was still evident.

But in cases of dislocation from congenital malformation, or as a result of disease, all such manipulations are either useless or inadmissible. In congenital dislocations there is always some fault of formation, which allows the head of the bone to slip from the socket. We may succeed in dragging it down to its proper place, but no bandage or machinery will retain it there. So also, as mentioned at page 30, in cases where the head of the femur has been pushed, unchanged in shape, from the acetabulum, in consequence of distension of the capsule by synovia, we may, by the aid of pulleys, drag it from the dorsum ilii and press it into its natural cavity; but it will not stay there, and both patient and surgeon suffer disappointment.

There are, I am aware, some surgeons who profess to have achieved success, but I know of no case sufficiently well authenticated to be considered trustworthy.

All that is left for us in such cases is to give proper instrumental support. For example, in cases of dislocation of both ossa femoris on the dorsum ilii, the pelvis becomes much more oblique than natural, and the lumbar region of the spine strongly curved forwards (lordosis). The patient's gait is very unsteady. A pelvic band of steel, with double side crutch, supports the body, relieves the lordosis, and affords the patient very considerable comfort.

I am no advocate for the forcible extension of joints, whether contracted or deformed, except in a few cases, where some very unyielding obstacle to *redressement* has to be suddenly overcome. The practice is of use after cases of rheumatic disease, when a bar of new bone prevents the proper movements of the limb, or where osseous union holds the bones in some abnormal position after all morbid action has subsided. Mr. Brodhurst relates an interesting case ('On Anchylosis,' p. 66): C. M., an officer in the Royal Engineers, was returning from the trenches before Sebastopol on the 24th of November, 1854, with a friend, when he was wounded by a bullet striking him in the median line of the abdomen, immediately below the umbilicus. In this position the ball struck on a button, and glancing off it, entered about three inches above the pubes. It passed into the groin, carrying with it portions of a match-box and fragments of other articles which were in his friend's pocket, and through which the ball passed to its destination. The ball lodged deeply in the upper part of the thigh, just below Poupart's ligament, displacing the femoral vessels outwards. Inflammation resulted, and an abscess formed, but the ball was not dislodged. Inflammation extended to the hip-joint, and confined the patient to bed with scarcely any power of movement, until the following April. Then it was discovered that the limb was fixed at an obtuse angle, and that the motion of the joint was lost. In March, 1857, Mr. Brodhurst found the thigh immovable and flexed, so that when the patient stood upright the sole of the foot was two inches from the ground. On the 30th March, chloroform having been given, extension was made. After a considerable effort a band of adhesions yielded, but the joint was not free. A renewed effort was made, and the remaining portion was ruptured with a loud snap. The last mentioned portion was a narrow band of bone external to the capsule. The limb was put into a gutta-percha splint which had been previously made. At the end of the third week the patient could almost bear the entire weight of the body on that leg. Motion was slow in being acquired, but by great perseverance in the use of passive motion, the thigh could at last be both flexed and extended.

In 1858 a young girl was under my care, in whom, after a severe attack of rheumatism of the right knee, the leg became flexed at a right angle. So complete was the union of the diseased bones, that the surrounding muscles had ceased to contract, on efforts being made to extend the limb. The usual treatment having failed, I forcibly broke through the adhesions, after having rendered her insensible by the administration of chloroform; a loud snap was heard, and the joint at once became loose. But no continued extension was then made. The limb was kept for a week in the semiflexed position. Then the leg was slowly drawn out straight by a suitable apparatus. She recovered completely, but the movement at the knee was limited in extent, and she required for many months the use of side irons. In making forcible extension, the surgeon must be careful to avoid lacerating parts which he would preserve. A surgeon of eminence, in my presence, while forcibly extending a contracted knee, tore across the integument, which had lost its pliancy and elasticity from the effects of previous and frequently recurring disease.

A lady under my care was thrown from her horse. The right elbow received a very severe injury of uncertain character, and long after the time when any injury to the bones must have been repaired, I saw her in consequence of the severe pain which she experienced in moving the limb. As she was anxious that something should be done, I determined to examine the limb by forcible flexion and extension while she was insensible by chloroform. The limb was readily put into any position, and some fibrous bands were torn. Severe pain followed the operation, lasting three to four days, but afterwards the original pain in the joint was more moderate, and by degrees the use of the limb was restored, although complete extension was not attained for some months afterwards.

No forcible extension should be practised in cases of active disease. The semiflexed position of the limb is that which gives to the patient the greatest amount of ease. To extend the limb is to press together the vascular and sensitive articular extremities, to put the ligaments on the full stretch; Nature points out how the limb should lie. Hence we should not yield acquiescence to the following directions:—"Supposing (in acute synovitis) the articulation to have already assumed an improper position, it is better to put it right *at once*, even if the existing inflammation is acute; for in unnatural positions the different parts of the joint are kept in a state of undue pressure, or of undue tension, either of which interferes with healthy nutrition, and so opposes the curative process. Under the influence of chloroform, the replacement can, at this time, be readily effected. The splint used should be well adapted to the limb, and be of *sufficient length*. . . . . The points here insisted on are, of course, applicable not merely to cases of synovitis, but of all diseases of the joints in which absolute rest is demanded."* To this practice I most strongly demur.

In most cases extension should be carried out slowly, and for this purpose apparatus is necessary. If the

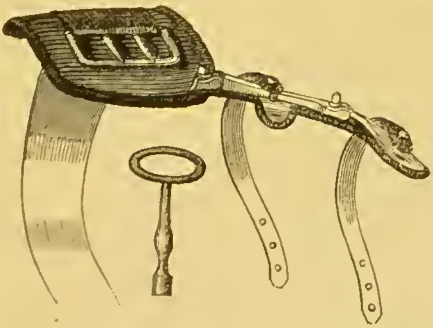

Fig. 3.—Apparatus to extend Contracted Fingers.

deformity be slight, a simple well-padded tinned-iron splint, with straps and buckles, will suffice.

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* Johnson in 'Holmes' Surgery,' vol. iii. p. 711.

But we may employ the jointed apparatus, worked either by the usual screw, or by the cog-wheel.

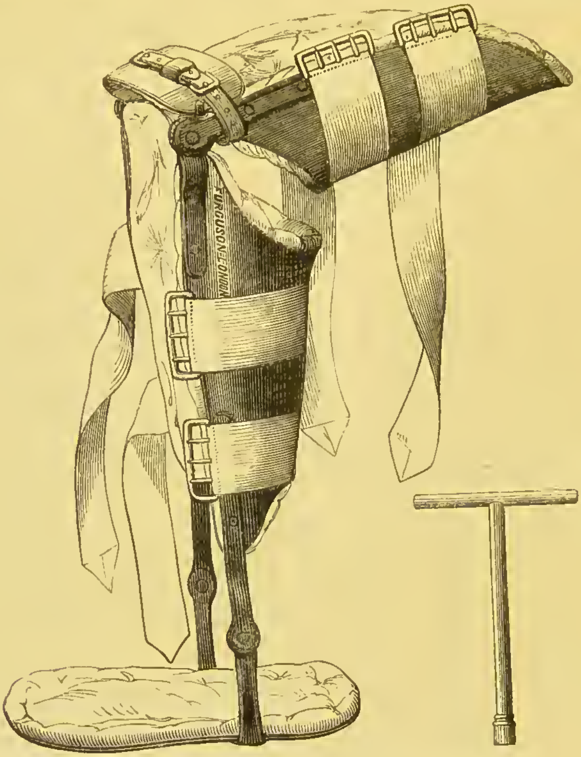

Fig. 4.—Apparatus to extend Contracted Leg.

In the case of the knee, it may be so constructed as either to be attached to the boot, in which case the patient may take his usual exercise; or it may have a plain footpiece, more convenient to one confined to bed. It is impossible to use the extending force too slowly; but it must be continuous, both day and night. Hence the apparatus is so made that the shoe may be detached, the rest of the machinery remaining. The same principle is applicable to all other joints, with modifications suitable to their anatomical configuration. I have seen practised on children, the subjects of sub-acute strumous inflammation of joints, the forcible extension and the attempted maintenance of the limb in one position by means of a mechanical apparatus. Such practice has never succeeded. In most instances the pain becomes insupportable; the apparatus cannot be maintained, and the limb becomes again semiflexed, but with aggravation of all the symptoms, and in some instances the preservation of the limb has been imperilled.

The rule therefore is absolute, viz., to leave a joint, the seat of inflammation, in the easiest possible position, generally the semiflexed, in which all parts are relaxed. If we employ a splint, let it be a flexible tinned-iron splint, with a pad, bent to the form of the limb. By means of general treatment, let all swelling subside; allow the synovial membrane to pass through its allotted phases of change; and then, when all morbid action is passed, and not before, "extend, if it be so desired, but extend slowly, reserving forcible extension for the rupture of osseous bands or adhesions which are so strong as to resist the usual apparatus.

The partial and spontaneous dislocation of bones following organic disease can never be overcome by sudden violence nor forcible measures. When we consider how many ligaments have been destroyed, what new adhesions may have been formed, and how the articular surfaces are often altered in form, we may readily comprehend how impossible is it to effect any improvement in this respect in many cases.

In the knee-joint, the bones of the leg are, at the close of disease, most usually pulled backwards by the hamstring muscles, semiflexed, and rotated considerably outwards. The inner condyle of the femur may become quite a prominent projection, while the limb soon acquires the character of knock-knee (genu valgum), the arch of the foot sinking as in talipes valgus. I repeat, forcible measures in such a case are worse than useless; indeed, they have so often failed, that some surgeons propose the operation of resection, a measure wholly uncalled for, and indeed most strongly to be reprobated as unsatisfactory in itself, and unnecessarily severe and dangerous.

If the patient should wish to have done all that surgery can effect, he must arm himself with patience, and he will not in the end be disappointed.

The subcutaneous division of the hamstring tendons will enable the surgeon, guided by the usual rules of orthopœdic surgery, slowly to bring the leg into a straight line. He should have made also an outside iron, with joint and cogwheel at the knee, to fit into the deformity of genu valgum, and by slow action to pull the bones straight in that direction also. He may raise the arch of the foot by means of a small elastic pad under the calcaneo-scaphoid articulation, and pull the ankle from its inward inclination by a strap and outside iron. All this can be effected easily and with certainty in a definite time; but the replacement of the articular surface of the tibia immediately under the femur is a proceeding much more difficult of accomplishment. Two very strong irons must extend from the boot to above the knee, and strong leather straps must drag the bones unremittingly in the required direction; the apparatus must be worn day and night.

Irksome as this treatment may be, it has the advantage of accomplishing more than can be done by any other known measure: it is painless; and during the whole period the patient can walk about, and in many cases follow his usual avocations.

For the treatment of both sub-acute and of chronic cases, I must refer the reader to the rules in the first part of this chapter. The selection of remedies must be dependent upon the skill and experience of the surgeon. I pass now to a brief epitome of the principal diseases peculiar to each articulation, inasmuch as our practice is very materially influenced by both the size and position of the articulation. In perusing them no one can fail to be struck with the fact that nearly all the morbid appearances are such as would be aggravated by exercise and improved by repose. To this rule, with certain modifications, there are two exceptions —namely, stiffness dependent on external thickening and consolidation of parts in old chronic cases, and the stiffness which supervenes on chronic rheumatism. In the latter, exercise favours the formation of those grooves which give to the joint motion, limited it may be to one direction, but that direction being precisely such as is most useful and advantageous to the patient.

Let me add one word of caution as regards pain being, under all circumstances, considered an indication of active disease. That it exists where cartilage is being shed from bone, or where bone is in a state of suppuration and under many other conditions, is indisputable; but it is also severe, and, if not properly managed, almost unbearable during some stages of the process of repair. The interior of a joint may have passed through the process of disorganisation, and fibrous bands of union may be in great part formed between the opposed bony surfaces; at this period some neighbouring muscles commence dragging the parts into an abnormal position; then new structures are pulled and stretched, and the surgeon fancies that active disease has recommenced. A strong bent splint properly applied and firmly attached, warmth maintained by means of flannel rollers, and opium administered by the mouth or hypodermically, will relieve these symptoms. Many a joint have I seen removed, thus circumstanced, by amputation; and it is always with a feeling of regret that I see those efforts of nature cut short by so summary a process.

CHAPTER VI.

DISEASES OF THE JOINTS OF THE UPPER EXTREMITY.

THE SHOULDER.

OF all the joints in the human body the sterno-clavicular is that which is least prone to disease. Gurlt mentions a case of partial luxation,* and the Museum of Guy's Hospital contains one specimen of bony anchylosis. I have seen some instances of syphilitic enlargement involving that joint and the neighbouring portion of the sternum.

The acromio-clavicular articulation is very liable to chronic inflammation, chiefly of rheumatic character; the effect of which is softening and elongation of the connecting ligaments, so that the shoulder and upper extremity sinks, and the end of the clavicle projects, forming a swelling terminating one inch from the extremity of the acromion. A similar appearance is produced by the well-known accident, dislocation of the acromial end of the clavicle: a condition which, as far as my experience goes, is irremediable. Fortunately, the results are not serious nor detrimental to the patient. Disease of this articulation is very commonly combined with disease of the shoulder-joint itself. We find a considerable development of osteophytes; the cartilage is generally entirely removed. These changes are accompanied during life by a worrying aching pain in the shoulder.

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* Gurlt, 'Beiträge zu Gelenkkrankheiten,' p. 239.

The shoulder-joint, or that between the humerus and the glenoid cavity, is not commonly the seat of synovitis: a swollen condition of that articulation usually indicates some more serious and complicated lesion. It is true that cases occur in which the synovial membrane alone has been supposed to be affected; but the treatment has been, in the most favourable instances, tedious and prolonged. Pus has been found in the cavity of the shoulder-joint in cases of blood-poisoning. Bouillaud ('Tr. Clin. du Rheum.,' art. *Abcès* 35, p. 105) relates the case of a man, aged twenty-two, who died from phlebitis following venesection. The left shoulder-joint was full of pus; and Beattie has published an instance of similar nature in the case of a woman who died twenty-six days after delivery.* Should a surgeon meet with a case of suppuration in the region of the coracoid process, he had better look closely into the condition of the shoulder-joint. An abscess in the proximity of an articulation usually indicates mischief within the joint itself. The frequent communication of the shoulder-joint with the bursa under the subscapular muscle is also to be borne in mind. The enlargement of the bursa under the deltoid by fluid and small millet-seed bodies has been mentioned under the head of 'Diseases of Bursæ.'

In most cases of synovitis, the inflammation after a time subsides under proper treatment, and the parts return to a normal state; but in many others there remains considerable thickening and a general stiffness of the joint. I doubt whether there are many cases of uncomplicated synovitis in which the disease in its progress extends to the cartilage and other structures. The cases which have been brought forward in illustration of this doctrine are, for the most part, instances of primary disease of the articular extremities of the bones. The osseous tissue is softer than natural, or is infiltrated with tubercle; and the inflammation of the synovial membrane, regarded as primary, is, in truth, secondary, and points to much more deep-seated changes.

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* 'Dublin Journal of Medical Science,' vol. xvi. 1840.

Suppuration within the synovial cavity can rarely be long mistaken. The constitutional symptoms become very severe, the pulse rapid, and rigors supervene. There is, in many cases, a peculiar feel in a synovial membrane filled with pus: it is as if the boundary were marked by a depressed line; the integument is often red, and disposed to point.

There are few conditions more severe than this. Abscesses may form up the limb, and the whole shaft of the bone may become diseased. Relief is sometimes afforded by a free incision into the joint.

In cases of inflammation involving the bone and all the other structures of the articulation, we find the whole region swollen; the soft parts matted together, and perforated by fistulous passages. These open near the axilla or the insertion of the deltoid, or, according to Gurlt, at some more distant point, *e. g.*, the mammary region. In these cases the fibrous capsule is softened, the tendon of the biceps destroyed, the bone denuded of cartilage, and ulcerated or hollowed out by one or more abscesses, some of which may contain portions of necrosed bone.

Thus the joint may remain for years, the source of constant and wearing pain, and the limb quite useless. In proper cases the operation of resection has been performed with success. Dr. Hodges, of Boston, Massachusetts ('On the Excision of Joints,' p. 44), affirms that it is fatal once in every $6\frac{1}{4}$, and fatal or unsuccessful once in every $4\frac{1}{6}$ cases of its performance for "white swelling." "But the ultimate results of excision of this joint, whether for injury or disease, are very satisfactory." In this opinion I concur. Should there be reason to believe that the usual form of disease exists in the cancellous tissue of the head of the humerus, the operation of excision, carefully performed, relieves the patient of his disease and leaves him a useful limb.

In the case of an adult, on whom I operated in 1858, death ensued from exhaustion following necrosis of the entire shaft of the humerus. The case was that of a man, aged fifty, in infirm health and unsuited for the operation; he had suffered many years from repeated attacks of acute inflammation, and the right shoulder-joint had been denuded of its cartilage. Being obliged to work for his living and use the limb freely, the surface of the humerus became ulcerated, and several little cavities formed containing small sequestra: abscesses gathered around the joint, and fistulous passages led to rough and denuded bone. The case went on fairly after the operation for a week, but then diarrhœa supervened and the patient died. My present experience would teach me, in such a case, to keep the limb at rest, to soothe pain by opiates, and to wait the progress of events, until the general health was improved.

I do not approve of the operation, except in very rare and exceptional instances, in the case of young children. Mr. Hancock, however, very properly operated in the case of a child with success, in consequence of the separation of the epiphysis from the shaft, following a blow.*

In speaking of the results of excision of the shoulder-joint after gunshot wounds and other injuries, Dr. Hodges remarks: "Uniting these two series of cases (quoted pp. 28 and 29), and adding to them six operations with three deaths performed by M. Baudens in Algiers, and three others, successful (one by Langenbeck and two by Testar), of which it is unknown whether they were primary or secondary operations, we have a total of ninety-six cases with twenty-five deaths, or a mortality of 26 per cent. Comparing the above results with the statistics of amputation at the shoulder-joint, as derived from Crimean experience, from which we learn that, of sixty operations, nineteen, or 31·6 per cent., were fatal, we have a result in favour of excision of 5·6 per cent."† Esmarsh observes, "It is curious that the operation on the left side seems to give less favourable results than on the right: six out of twelve died of those resected on the left, and one out of seven of those resected in the shoulder on the right side." He also says that "a similar proportion held good in resection of the elbow: for of those operated upon on the left four in nineteen, on the right two in twenty, resections proved fatal."‡ I have no experience to offer on this point.

Secondary excisions are not followed by the mortality usually supposed to attend them. In fifty-three primary operations performed during the Schleswig-

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* 'Lancet,' July 6, 1850.

† 'On Excision of Joints,' p. 29.

‡ Statham's 'Stromeyer and Esmarsh,' p. 68.

Holstein war there were sixteen deaths, or a mortality of 30·18 per cent.; and in thirty-four secondary operations six deaths, or a mortality of 17·64 per cent., being 12·54 in favour of the latter.

We should remember, however, that cases of deferred operation are, for the most part, slighter than those requiring immediate interference; also that in very many cases of immediate amputation the injury is of so severe a character as to threaten life.

We meet with instances of osseous anchylosis of the shoulder-joint. They are not, it is true, very common, but they prove that Nature is equal to the task of repair. The cases are, I should suppose, instances of rheumatic character, and the fusion of the humerus and scapula is complete. One specimen is in the Museum of St. Bartholomew's Hospital (Sub-series B., No. 50), a scapula and humerus united by bone. The head of the humerus has disappeared, and the upper part of the shaft is fixed by an irregular growth of bone to the remains of the glenoid cavity and the base of the coracoid process. The spine and inferior costa of the scapula are thickened. In another case, described by me in the 'Transactions of the Medical and Chirurgical Society,' 1855, the osseous fusion was yet more complete. The only appearance presented during life was a flattened condition of the shoulder from atrophy of the deltoid muscle. The movements of the limb—including, of course, the scapula—seemed very perfect.

Most persons have experienced, after exposure to cold and damp, an aching pain in the shoulder, very properly ascribed to rheumatism. It is relieved by warmth, by the employment of stimulating liniment, by counter-irritants of stronger character; but it is apt to return on exposure, and to be especially troublesome at night. Let us see what are the morbid changes which the continuance of this pain indicates. The affection is termed "chronic inflammation of the shoulder-joint." We owe very much of what we know of the pathology of this affection to the industry and research of Mr. Edwin Canton.*

Chronic inflammation of the shoulder-joint is attended by softening and stretching of the ligaments, especially the capsule; and the head of the humerus is partially luxated in these cases upwards and inwards. In some works on surgery, a partial luxation of the humerus upwards, *from accident*, is described; most probably it is the condition here mentioned, namely, a result of chronic rheumatic inflammation; but in the same disease the head of the bone may be partially displaced in any direction.

The next change consists in enlargement of the head of the bone, but not equally so, the increase being chiefly about the tubercles, and that part immediately contiguous to the articular surface. This latter, namely, the articular surface, undergoes, on the other hand, loss of substance, becoming flattened and apparently widened, and, losing its globular form, acquires an egg-shape. The surface, thus enlarged and extending over the new bone, may preserve the cartilage in some parts, and in others present a rough and knobbed aspect, the surface of these irregularities, however, being hard and ivory-like. This ivory-like hardened surface is often marked by grooves, showing the direction of the movements of the joint, and surrounded by osteophytic growths, some of which become loose or even quite detached. When the head of the bone is partially dislocated, a deep groove often divides it into two parts, marking the surfaces of apposition. The glenoid cavity is usually enlarged, often double its normal size, and round; in some cases it is deeper than natural, in others it is extended forwards, and divided by a line into two. The head of the humerus touches the coraco-acromial arch; and in some instances the acromion is thinned, and even divided into two pieces.

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* E. Canton, 'London Medical Gazette.' New Series, vol. vi. 1848.

That portion of the tendon of the biceps within the joint rarely remains entire. In those few cases in which it has been so found, it has been displaced from the inter-tubercular groove. It is generally thinned, flattened, divided into separate strings, and adherent; often entirely absent and torn, as it were, from that portion without the joint, which, together with the corresponding portion of the muscle, is atrophied.

The capsule is thickened in parts; in others, it may be thinned. It acquires a greater capacity than natural; the synovial membrane is studded with numerous little fibro-cartilaginous bodies, but its cavity contains a moderate quantity of thick synovia. In some cases the supra and infra-spinatus tendons, and that of the subscapularis, have been found separated from their attachments.

The difficulty which we sometimes experience in old cases, of distinguishing between the consequences of some obscure accident in the shoulder, and the effects of chronic disease, induces me to give a list of the possible accidents to this articulation, as substantiated by pathological specimens :—

A. FRACTURE OF THE ANATOMICAL NECK. (Intra-capsular fracture.)
  a. Fractures without impaction, namely:
    1. Simple fracture through the anatomical neck.
    2. Fracture through the anatomical neck, with luxation of the head of the humerus.
  b. Fractures with impaction:
    1. Simple fracture through the anatomical neck, with impaction.
    2. Fracture through the anatomical neck, with impaction, and with separation of the tuberosities.
    3. Fracture through the anatomical neck, with rotation of the upper fragment, and impaction.

B. FRACTURE AND SEPARATION OF THE GREAT TUBEROSITY. (Extra-capsular.)

C. FRACTURE AND SEPARATION OF THE LESSER TUBEROSITY. (Extra-capsular.)

D. SEPARATION OF THE EPIPHYSIS FROM THE DIAPHYSIS OR SHAFT. (Extra-capsular.)

E. FRACTURE THROUGH THE SURGICAL NECK. (Extra capsular.)
  a. Fracture without impaction:
    1. Simple fracture through the surgical neck.
    2. Fracture through the surgical neck, with luxation of the upper fragment.
  b. Fracture with impaction. The lower fragment is wholly or partially impacted in the upper.*

THE ELBOW-JOINT.

As in other joints, so in the elbow we meet with cases of pure synovitis on the one hand, and on the other of disease commencing in the bone and spreading thence to all the component structures. The former attacks young persons of delicate constitution and of strumous habit. It is characterised by swelling of oblong form on either side of the olecranon. These swellings, by increase, unite behind the humerus, and raise the supinator muscles, by intra-synovial effusion, from their attachments on the outer side of the arm. The forearm is semiflexed, and in course of time the lateral ligaments become elongated, and the whole joint is looser than natural. In this articulation we meet also with the light-brown coloured degeneration of the synovial membrane, in which it is reduced to a mass of microscopic cells, and acquires an enormous thickness. In the Museum of the Hospital (Ser. II., No. 12) there is a specimen of disease of fifteen months' duration, from the arm of a man aged sixty. The synovial membrane is converted into a light-brown coloured substance of firm texture, one-half to three-quarters of an inch thick, with white lines traversing it in various directions, and with a smooth, white surface. The morbid change ceases at the border of the articular cartilage. Around the neck of the radius the thickened synovial membrane forms a fold, which projects into the joint, and the cartilage and bone appear to be sound.

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* After Gurlt, 'Beiträge zur pathol. Anat. d. Gelenkkrankheiten,' S. 283.

Disease "of the joint" is characterised in its early stages by the usual symptoms of so-called ulceration of cartilage. In the course of the disease abscesses form, leaving fistulæ, which lead to denuded bone, or to the cavity of the joint, into which they may extend so as to permit the passage of the probe from one side to the other of the limb. The upper and forearm become much shrunk beyond the limits of the disease; the forearm is usually semiflexed and somewhat prone; movements exist, but to a limited extent, and always attended by pain. The ulceration of the bone may be superficial or deep: we meet with abscesses in the cancellous tissue; a soddened condition of the same structure; or pieces of necrosed bone which serve, so long as they are there, to keep up the disease.

In some cases the disease is apparently limited in extent. Thus, the head of the radius may be affected, and the surrounding structures appear swollen, the ligaments become softened so as to permit a subluxation, generally backwards. In other instances the greater sigmoid cavity becomes enlarged, when the humerus comes forward on the coronoid process, a condition which has been mistaken for dislocation, the result of accident.

Pus in the cavity of the joint makes its way externally either on the outer or inner side of the tendon of the biceps. In these situations it meets with least resistance from fibrous membranes; and here we mostly find fistulous openings.

In some chronic forms of inflammation, mostly of rheumatic character, the joint is surrounded by an abundance of osteophytes. Osseous anchylosis is rare in strumous subjects, although the patient may have, on the subsidence of the disease, a firm, useful limb. The bones in these cases are mostly porous and spongy, and easily broken down; but, under favourable circumstances, firm bony union has been observed, *e.g.*, Museum of St. Bartholomew's Hospital, Ser. I., Sub-ser. II., No. 29: all the articular surfaces are united by bone, and also surrounded by it; the joint is in the semiflexed position. (*Ibid.* No. 30): complete osseous union between the humerus and ulna. (*Ibid.* No. 39): complete osseous anchylosis. Specimens are also contained in the Museum of the College of Surgeons.

The possibility of such a termination is a reason for pausing before recommending the removal of a diseased joint by resection.

Chronic inflammation of the elbow-joint is attended by an almost constant removal of the articular cartilage. In all affections of this articulation the subsequent stiffness and want of movement is remarkable. There are noticed the same grooves in the hardened and eburnated articular surface as has been described elsewhere: the trochlea of the humerus is "rubbed down" and altered in form; the sigmoid fossa is shallow, and numerous bony growths surround the joint. The coronoid process of the ulna is sometimes flatter than natural, and there is a partial displacement of the humerus forwards which rests on its upper surface. Changes of form are noticed in the head of the radius, which may become loosened from its normal attachments, and partially luxated. The following illustrates some of such changes (Museum of St. Bartholomew's Hospital, Sub-series B., No. 53)—a humerus, radius, and ulna. In consequence of chronic disease of the elbow-joint the forearm appears to have been for a long time fixed in a position of extreme flexion, with the hand in extreme pronation. The articular surface of the humerus is much deformed; the internal condyle is reduced in size and pointed; the trochleal cavity is nearly obliterated; the external condyle has a part of its surface hardened and polished; and nodules of new bone have been deposited around the borders of the articular surface. The outer division of the great sigmoid cavity of the ulna is hard, polished, and superficially grooved; the inner division is soft and rough, as if it had been deeply ulcerated. The lesser sigmoid cavity is obliterated; and, just below its place, there is a large and deep pit in which the tubercle of the radius rested. The head of the radius is directed backwards from the shaft. The articular surface has lost its cartilage, and new bone is deposited around a great part of its border. The anterior border of the head of the radius, which rested on the front of the external condyle of the humerus, has formed a wide and slightly concave surface, which is covered by hard, polished bone, like that on the surface of the condyle itself. The lower ends of the shafts of the radius and ulna are healthy.

It may assist in a diagnosis to give a list of traumatic luxations, as contrasted with those produced by the effects of chronic disease. In the elbow-joint there may be congenital malformation and osseous union of the bones, congenital dislocations, &c., in general easy of diagnosis.

Traumatic dislocations may be thus arranged :—

DIAGRAM.

- A. *Simultaneous Dislocations of both bones.*
  - *a.* backwards
    - *α.* complete.
    - *β.* incomplete.
  - *b.* forwards.
    - *α.* with fracture of the olecranon.
    - *β.* without fracture of the olecranon.
  - *c.* outwards.
    - *α.* complete.
    - *β.* incomplete.
  - *d.* inwards.
    - *α.* complete.
    - *β.* incomplete.
  - *e.* Simultaneous dislocation of both bones in opposite directions.
- B. *Dislocation of the upper end of the Ulna.*
  - Backwards.
- C. *Dislocation of the upper end of the Radius.*
  - Backwards.
  - Forwards.
  - Outwards.
  - Incomplete.

Respecting excision of the elbow-joint, we may affirm that it is, when possible, always preferable to amputation, inasmuch as it leaves the patient a limb of considerable usefulness. In excision for disease, death occurs once in $7\frac{14}{15}$ cases (Hodges, 'On Excision of Joints,' p. 73), and the operation fails of its primary intention by death, amputation, or other cause, once in $3\frac{17}{34}$ cases. Partial excision, here as elsewhere, is a frequent cause of unfavourable results. This rate of mortality appears to me to be too high.

The operation may be performed by an **H**, or by a single incision through the integument, the olecranon being the first part removed. The ulnar nerve is the only structure of importance likely to be wounded unintentionally.

As an instance of the somewhat reckless manner in which, a very few years ago, excision of this joint was performed, I will quote the following case from the 'Trans. of the Pathol. Society,' 1859 (p. 223):—A lady, aged forty-seven, bruised her elbow: this accident was followed by pain, swelling, and considerable inflammation. For two years the arm was useless; and for the latter period the symptoms were more severe. The esteemed surgeon, now no more, who examined the joint, while the patient was under chloroform, came to the conclusion that it was *irretrievably* destroyed. But "the disease of the bone was limited to the external condyle of the humerus, the synovial membrane being thickened, pulpy, and gelatiniform!" Excision of the joint was performed, and the patient died in five days. No very accurate account of the examination of the parts is published; but we learn, first, that the specimen "admirably exhibited, in its fresh state, the pathological changes which take place during the separation of diseased portions of bone from surrounding healthy structures; and also the efforts Nature had made in other parts to create repair after admitting so much destruction." (Op. cit., p. 223.) The joint, therefore, was under process of repair; and in all probability the result of the case might have been different had the operator been more familiar with "the influence of rest in the treatment of disease," and had added to this the value of patience.

Few joints have been more frequently subjected to forcible extension than the elbow. The smaller size of the articulation as contrasted with that of the knee, the readiness with which force can be applied, are circumstances which favoured the performance of the operation. The ultimate result has appeared to me to be the same, or nearly so, in all cases. The forearm may be flexed or extended to any angle, but the limb remains stiff; no free motion is restored. Hence the idea which was once entertained, that repeated forcible extension might become the means of restoring the proper movements of the forearm after disease, proves to be fallacious.

Let me relate the *post mortem* appearances of some joints which have been the seat of acute and chronic disease; and thus perhaps the explanation will be apparent why stiffness of the limb should remain. It is unnecessary to remark, that the treatment now under review is chiefly applied to cases of the latter kind; but the evidence afforded by both sets of morbid appearances will be interesting.

Lobstein relates the particulars of a case of ulceration of the articulating surfaces—protrusion of the head of the radius through an ulcerated opening of the skin. On the elbow of a man, aged 25, there were two large sores, one on the internal condyle, the other on the external condyle of the humerus. The ligaments were entirely destroyed, and the head of the radius protruded through the corresponding opening of the skin.

The articulating surfaces were rough, the muscles partially destroyed and degenerated. The nerves had retained their normal structure, though thickened externally.*

The severity of the inflammation, oftened aggravated by want of proper treatment, may tend to abscess or mortification of the bone. Such a case is related by Meinel ('Ueber Knochentuberkeln'), who saw in a youth, aged 18, who had suffered from numerous ulcerations of the skull, ulcerations of the cartilages in the right elbow-joint, with a carious condition of the surfaces of the bones, and exposure of the cancellous structure. Between the condyles of the humerus, and imbedded in the substance of the bone, was a round cavity, containing a thick substance, like tubercle (inspissated pus?) A similar cavity was found in the sigmoid extremity of the ulna. The cavity for the head of the radius was completely destroyed. With this ulcerated condition of the extremities of the bones is sometimes combined a porous and spongy state of the osseous tissue (Museum of St. Bartholomew's Hospital, Ser. II., No. 30), or the development of osteophytes.† Necrosis has been noticed and recorded in very many instances: 1. At the lower end of the humerus, combined with anchylosis of the joint, by Michet.‡ 2. In the upper extremity of the ulna, combined with partial anchylosis of the joint (Museum of Royal College of Surgeons, No. 3164). In the Museum of St. Bartholomew's Hospital (Ser. I., No. 209) there is a specimen showing part of the spongy substance of the humerus in a state of necrosis, and lying loose in the medullary cavity : a long fistulous passage passes into the articular cavity, which is in great part deprived of its cartilage.

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* 'Traité d'Anat. pathol.,' tom. ii. p. 309.

† Syme, 'Treatise on the Excision of Diseased Joints.' 1831.

‡ 'Gaz. Méd. de Paris.' 1840, tom. viii.

The history of diseases of the elbow-joint illustrates the fact that, in persons of strumous habit, bony anchylosis does not take place. The only apparent exception to this rule is when, after long continued local disease, the strumous taint seems to have worn itself out, in which case the processes of repair become the same as in individuals perfectly healthy.

In the Museum of the Royal College of Surgeons of England there are two specimens of considerable interest: one (No. 3344) showing osseous union (the forearm at a right angle), without any considerable alteration of form; the other (No. 3346) with considerable change and atrophy. The Museum of Anatomy in the University of Berlin (No. 2252) contains a specimen of anchylosis of both elbow-joints, from a man aged 50. In the right arm, the humerus and ulna are united at a very obtuse angle, both bones passing by fusion one into another, so that the trochlea is no longer visible. The upper part of the head of the radius is wanting. The bones are somewhat atrophied. In the left arm the same changes exist; the bones, however, being at a right angle. In all probability, the cause of the disease was rheumatism. In the Museum of St. Bartholomew's Hospital (Ser. I., Subs. B., No. 29) there is a specimen of similar origin, in which all the three bones are blended together at their articular extremities.

In chronic inflammation, the morbid changes and processes of repair are more generally important as regards the mode of treatment now in question.

Chronic rheumatic inflammation terminates often in changes such as are shown in a valuable specimen from the Museum of the Royal College of Surgeons, taken from a man aged 50. The articular surfaces of both joints, instead of being covered with cartilage, are smooth, hard, and in parts polished. On the margin are numerous knotty osteophytes of hard and compact tissue, but covered with glistening fibrous structures. The head of the radius is larger than natural, by the formation of new bone, and directed backwards; a great part of its anterior surface being flattened, corresponding to a similar flattened surface in the front of the outer condyle of the humerus.

I have seen a case in which, after long standing disease, a thick layer of new bone formed around the shaft of the humerus to the borders of the articular surface. The osseous substance presented a vascular cancellous texture, and was surrounded by a layer of compact substance which was covered by the periosteum of the original bone. The same changes had occurred both in the radius and ulnæ. It was doubtful whether the new bone formed in this case were a deposit between the periosteum and the surface of the shaft, over which deposit a layer of compact tissue was developed, or whether the disease consisted in the expansion of the walls of the bones by the gradual separation of their outer from their inner layers, and in the formation of cancellous new bone between them.

In specimen 207, Ser. I., Museum of St. Bartholomew's Hospital, a portion of cancellous tissue has separated after necrosis and lies loose in the medullary cavity; a long fistulous passage leads from the medullary cavity, through the lower end of the humerus, into the elbow-joint. The greater part of the articular cartilage has been removed from the bones, and the remains of the synovial membrane are thickened.

The following case, related by Cruveilhier ('Traité d'Anat. pathol. générale,' tom. i. p. 465), is supposed to have been one of incomplete dislocation, brought on by ulceration of the articular surfaces. The articular extremities of the humerus, radius, and ulna, were without any covering of cartilage, hypertrophied, and misshapen. The humerus projected over the bones of the forearm, and accordingly the extremity of the olecranon was taken from its fossa in extension. In no position did the articular extremities of the bones exactly correspond, but in none did they completely separate. The greatly stretched musculus brachialis internus (anticus) was divided into three portions, of which the middle only was inserted into the lower part of the coronoid process. The two lateral portions, which slipped over the borders of the trochlea of the humerus, had each a sesamoid bone, which corresponded with a concave surface in the humerus. There was adhesion between the tendon of the biceps and the denuded surface of the humerus. There were two other sesamoid bones posteriorly, one in the anconeus, the other within the external lateral ligament.

THE WRIST-JOINT.

Diseases of the wrist are serious, inasmuch as the extent of morbid change among the numerous little bones of the carpus is rarely limited, and cannot be easily ascertained. The cases are for the most part of strumous or of rheumatic character.

The effects of strumous disease is shown in No. 40, Ser. I. (Museum of St. Bartholomew's Hospital) on the left side, the carpal bones are nearly destroyed, and there are large deep cavities, bounded by soft, greasy, crumbling bone, in the adjacent parts of the bones of the forearm and metacarpus; on the right side the ulceration is extensive, but superficial. No. 73, Ser. I., is an instance of necrosis of the lower end and articular surface of the radius, following a peculiar change of structure. In cases such as these we find the soft parts greatly swollen during life, abscesses burst, leaving fistulous passages; the hand droops, becomes weak and useless. The treatment consists in maintaining the bodily strength, and in enjoining complete rest for many months, or even years. No operation can be of any avail, except to remove dead bone already loosened; and even then the amount of relief is uncertain. In severer cases, especially in the adult, amputation may be necessary.

In consequence of the anatomical relations of the bones, the lower extremity of the radius often participates in the disease, and sinking downwards, *i.e.* towards the palmar aspect of the limb, gives to the lower end of the ulna an appearance of undue prominence. Gouty and rheumatic inflammation often attacks the carpus. I have seen the disease more frequently in females, but men are subject to it, especially to that known as gonorrhœal rheumatism. In Ser. II. (No. 23, Museum of St. Bartholomew's Hospital) we have "the bones of the wrist exhibiting the effects of rheumatic inflammation in the whole of the carpal and metacarpal joints. The articular surfaces of the several bones are extensively ulcerated, some superficially, others deeply; and there is a very abundant formation of new bone around the ulcerated parts." In these changes the attack came to an end, leaving the patient during life a limb that was sufficiently useful. The obvious treatment of such a case would have been the administration of such remedies as tended to shorten the rheumatic attack; the maintenance of the limb in a quiet state, supported by a splint; and the administration of opium to alleviate pain. After the cessation of the disease, every movement should be encouraged.

The proximal extremities of os magnum and os unciforme form a rounded head, covered by cartilage, and received into a cavity or socket formed by the scaphoid, semilunar, and cuneiform bones. In weakly persons, especially young girls, the fibrous bands which hold these bones in place yield and become elongated, when a prominent bony swelling is seen on the back of the hand. This deformity, happily, does not constitute any serious annoyance, for there is but one way to put it right, namely, to hold the hand in one position, and to apply unremitting pressure to the displaced bones, until the fibrous structure has had time to recontract, and to acquire greater strength. Few persons will submit to the necessary prolonged course of treatment for so slight an inconvenience.

We meet with occasional instances of synostosis, or congenital fusion of two of the carpal bones which should remain distinct, such as the semilunare and cuneiforme. Such accidents are unimportant. Indeed, it must be remembered that both the os scaphoides and os unciforme are primitively distinct, and represent two bones, fused together in man, but permanently distinct in some animals, *e.g.* the seal. Gouty deposits are often met with in this region. We find these unorganised masses both in the articular cartilage and upon it, and around the joint itself; it encroaches, also, upon the tendons and their sheaths, rendering the movements stiff during life. This substance has even been found in the spongy tissue of the bones. In the Museum of the Royal College of Surgeons, No. 964, we have a specimen of gouty deposits on the lower ends of the metacarpal bones; two small cavities, like abscesses, lie on the dorsal aspect of the metacarpal bones, in which probably the same matter had been deposited. They do not communicate with the joint. Malignant affections belong to the diseases of "bones."

Respecting the operation of resection of the wrist, the following conclusions of Dr. Hodges appear supported by our present amount of evidence: "In the present state of our knowledge, excisions of the wrist-joint, whether partial or complete, being followed by a large proportion of failures requiring a very long treatment, and when successful the usefulness of the hand being so limited, are operations not sanctioned by sound judgment or conservative surgery."

Club-hand.—Congenital deficiency of the radius. Cases are occasionally seen in which the radius is absent; the hand is generally imperfectly formed, and articulates at an angle with the ulna, which may be larger than natural. Gurlt has collected the particulars of six such cases, recorded by Roger and Houel, by Davaine, by Von Wiebers, by Prestat, and Cruveilhier. No surgical interference is likely to be of avail in these cases.

Webbed Fingers is a troublesome deformity, and their separation one from another is a difficult and often a disappointing proceeding.*

A supernumerary thumb is the most frequent congenital irregularity of the digits; next, a supernumerary little finger. I removed one from an infant January 30th, 1857, in whom the hand in other respects was perfect. The next frequent irregularities in development, either of deficiency or excess, are in the following order: those of the fore-finger, those of the ring finger, those of the middle finger. In all cases of supernumerary digits the tendons are either imperfect or completely absent, but the bones are united one to another and to the hand by moderately well-formed joints.

It is interesting to remark that these instances of irregularity follow the same successional order as the disappearance of the digits in the lower vertebrata, until we arrive at the solidungula, as the horse, which is supported by one toe, the representative of the middle finger. The same law affects the disappearance of the carpal bones, and may be traced equally in the foot.

Cases of *Contraction of the Fingers* are often met with in practice. They may be congenital, when we usually have to encounter some imperfection or deformity, which renders surgical interference of doubtful benefit. In these cases it is impossible to explain their occurrence on the ground of intra-uterine pressure. I have seen instances in which the thumb was flexed into the palm, the fingers closing over it; also a case in which the thumb was free, the fore-finger semiflexed, and the three remaining fingers completely flexed into the palm. There may be bands of integument, abnormally developed, acting on the hand. No special rules for treatment can be laid down ; the greater the amount of deformity, the less chance is there of relief.

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* An apparatus for effecting this end by pressure has been lately constructed by the Messrs. Fergusson of Giltspur Street.

Non-congenital or acquired contraction of the fingers proceeds from a variety of causes. The most manageable, and perhaps the most common, is that which is due to a thickened and contracted condition of the palmar fascia : this structure is often preternaturally vascular, and may become adherent to the skin. The affection is seen in persons who use the hand greatly in one occupation, such as woodsmen. One of the most marked cases which ever came before me was that of a backwoodsman from the United States, who for many years had had the axe constantly in his hands. The fingers of both right and left hands were almost fixed in the semiflexed position. I attended, in 1861, an officer in the army, a skilled flute-player ; the little and ring fingers of the left hand had become so much contracted as to prevent his enjoying his favourite instrument. Proper treatment afforded complete relief. We find that the fingers come down slowly and in succession by an almost imperceptible increase in the extending force. Contractions proceeding from injuries, especially when they involve the tendons, whether in the finger, the palm, or wrist, are difficult of management in proportion to their degree. A tendon torn or injured in its sheath generally becomes adherent to the sheath, and consequently

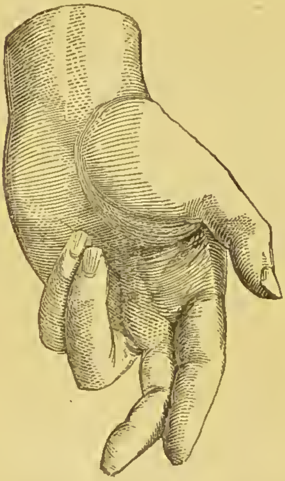

Fig. 5.—Contracted Fingers.

useless. Gout and rheumatism affect the fingers so as to induce contraction; paralysis of the extensor muscles is followed by preponderating action of the flexors. A spasmodic contraction of the fingers has been described.

In cases where the deformity depends on thickening of the palmar fascia, and also in the less favourable cases where it proceeds from injury done to the tendon, our chief reliance in treatment should be on rest and extension. The temptation to the surgeon to divide or to extirpate the morbidly thickened parts is doubtless often very great; but although he might by such a measure, which is always severe, succeed in putting the contracted finger straight, he could not, by any known means, prevent recontraction, which would leave the patient in a worse condition than before.

The general health may need supervision; habits of temperance should be enjoined, especially in persons of rheumatic habit. This state of the fascia may be due to the presence of some morbid material in the blood, as is often the case with affections of the skin. The apparatus by which the contraction is to be overcome is represented at page 85.

The extending force must act very slowly, that the skin be not rubbed over the knuckles. In severer cases the apparatus may include the greater part of, or the entire hand; under which circumstances a broader padded plate of metal extends over the dorsum of the hand to the wrist, where it is attached by straps and buckles.

When the cause of the contraction lies in the tendons, they must be divided by the usual subcutaneous operation. The division should be in the palm of the hand, and not in the synovial sheath. I have effected the division successfully at the wrist. At the end of four days the wound is closed, when the extending force is to be applied.

In cases of contraction of the fingers connected with gout or rheumatism, the surgeon has to deal with the morbid change produced by such diseases. The articular cartilages are degenerated into fibrous tissue, urate of soda or some other salt is deposited in the parts around, the ligaments are elongated, the bones themselves displaced. When the inconveniences thus produced are very great, benefit may be obtained by graduated extension and passive movements; but our sphere of doing good is limited.

Contractions consequent on the paralysis of a set of muscles, and the preponderating action of the other, may be easily overcome; but, inasmuch as voluntary movements cannot be restored, the patient's general condition is not improved, except as regards the simple deformity.

CHAPTER VII.

DISEASES OF THE JOINTS OF THE LOWER EXTREMITY.

THE HIP.

I.—*Congenital deficiency* of the ligamentum teres is a condition which, if it occurs at all, is associated with malformation of the bones composing the hip-joint. Most of the cases which have been recorded are evidently instances of destruction of this ligament from rheumatic disease.

II.—*Atrophy of the head and neck of the Femur* is seen in cases of infantile paralysis * as well as in advanced old age. Gurlt speaks of congenital atrophy; the same happens, too, in limbs which have been amputated. In cases of infantile paralysis and of atrophy following amputation, the bone becomes absolutely smaller than natural (concentric atrophy). In cases of atrophy from old age, the shell of bone remains, but the interior cancellous tissue is removed, a semi-fluid fat occupying its place (eccentric atrophy).

Disease of the Hip-joint usually occurs in persons of either strumous or of rheumatic habit; its symptoms, progress, and results vary very considerably under these conditions.

Strumous disease renders the head of the femur light, friable, carious, or ulcerated; the process of repair, when all morbid action is over, is imperfect. Rheumatic disease will render the head of the femur hard, porcellanous, and denser than natural. When morbid action has passed, there may be complete osseous fusion of the femur and the acetabulum, or considerable alteration of form. There are, of course, cases which present deviations from this rule, but it holds good in general. In the Museum of St. Bartholomew's Hospital there are the following two specimens :—

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* *Vide* Chapter on Infantile Paralysis, p. 253.

Series II., No. 16. *Strumous disease.*—Portion of a child's femur, of which the greater part of the head has been destroyed by ulceration (strumous). A portion of the head remains, but it is completely detached and ulcerated on every surface.

No. 20. *Rheumatic disease.*—A hip-joint. In consequence, probably, of rheumatic disease, the acetabulum is greatly enlarged, and has assumed an oval form. The head of the femur is enlarged, and adapted in its form to the acetabulum. All the articular cartilage is removed, and the surfaces of the bones are smooth, hard, and polished. The capsule of the joint is thickened, and upon its internal surface, around the neck of the femur, there are several groups of slender pendulous growths.

Between the two conditions thus described in the preparations referred to, the shades of difference are infinite; but both in the consideration of possible morbid changes in a case, and in the selection of remedies for treatment, these leading pathological characteristics should never be lost sight of.

Strumous disease of the Hip-joint.—Strumous disease of the hip-joint is essentially a disease of infancy or early life, and it occurs for the most part in children of fair hair, light blue eyes, and delicacy of build. The causes which produce it are generally slight; so much so as to indicate pre-existing morbid condition of the structures peculiar to the articulation. Sir B. Brodie thought that the disease commenced in the articular cartilage; Mr. Aston Key, in the ligamentum teres; others, in the synovial membrane. Although we cannot state with positive certainty the precise sequence of morbid changes, yet we have reason to believe that, in the first place, inflammation of chronic or sub-acute character commences in the cancellous structure of the head of the bone, and that the synovial membrane and the ligamentum teres are affected secondarily. This last structure is almost always found altered whenever we have opportunities of examining cases recently affected. In one instance of examination in the early stage of the disease, Fricke ('Annal. der. Chirurg. Abtheilung des allgem. Krankenhauses in Hamburg.' Bd. 2. 1833. S. 290) states that he found in the body of a boy, aged four, all the muscles, vessels, and areolar tissue, and the exterior of the capsule of the joint sound; there was no fluid in its cavity; the head of the bone lay naturally in the socket. But the synovial membrane was in parts injected with blood and swollen; the ligamentum teres felt firmer than natural, and thinner in its middle; the articular cartilage appeared sound. Upon making a section of the bone, he found in the medullary cavity and cancellous tissue a yellowish-white, firm, hard mass; the cancellous tissue redder and more vascular than natural. The diseased head of the bone was one and a half line wider than the sound one. The neck of the femur of the diseased side was two lines shorter than the sound one.

It is in this stage of the disease that the diagnosis is difficult. But the symptoms appear to be constant. A child does not show the usual disposition to run about and play; there is a slight limp, especially in the morning, but it seems to wear off; pain is complained of, generally seated in the knee, but the movement of that joint is free. The pain is most troublesome at night. It is the obturator nerve which transmits the feeling of pain: one branch going to the hip-joint, another to the knee. Abduction of the limb is painful at the hip. If the surgeon be called upon to examine the patient, he finds, in addition, pain, often severe and unexpected by the child, on pressure behind the trochanter or on the pectineus muscle, or wherever the joint can be reached; pain also when the thigh is extended and the capsule rendered tense. The buttock is slightly flattened. At this period of the disease the child may recover without deformity: that is to say, provided the parents are in a position to sanction the treatment which is necessary, and have a sufficient amount of resolution to persevere.

The little patient should be at once forbidden to put the foot to the ground for any purpose whatever. He should lie on a movable couch for many months, until the inflammatory symptoms have quite subsided, and even then the use of crutches may be desirable. The hip should be rubbed with a strong liniment, or with blistering liquid, or some other form of counter-irritant, kept warm with flannel, spongeo-piline, or poultices. Cod-liver oil or tonics should be administered, and a residence provided at some bracing place by the sea-side, *e. g.*, Brighton, Ramsgate, Margate. More commonly the necessary precautions are neglected after the immediate symptoms have been relieved. The disease then makes further progress as follows. The flattening of the nates becomes more marked, and the fold of the buttock is nearly obliterated. In a female child the valva will be seen at a lower level than on the sound side. The limb becoming weaker and the joint more painful, the child rests as much as possible on the sound limb, sinking the pelvis of the affected side and throwing the thigh forward, thus giving the appearance of elongation of the limb. This is the "apparent lengthening" of some authors. The "apparent shortening" is the opposite condition, namely, the pelvis is tilted *upwards* on the affected side; the tops of the toes just lightly touching the ground. This is the position which the limb assumes in those who are forced to go about during the progress of the disease in order to get their living. They walk with a stick, and use the affected limb as little as possible. About this time abscesses are apt to form either in the buttock or the front of the thigh. Whenever an abscess forms in the neighbourhood of a joint, the surgeon should look closely into the state of the articulation. He may open the abscess, or let it burst, as circumstances indicate; but the patient, though relieved of certain symptoms, does not get well. The hip is more painful; he has night-sweats and becomes emaciated. Next commence those more serious changes which lead to ulceration of the head of the bone and of the acetabulum, to shortening of the limb, and, in some instances, to dislocation of the femur on the ilium.

There are cases in which the greatest amount of destruction and ulceration of bone is in the acetabulum, and these cases are usually attended with more than the common amount of pain. In general, the ulcerative process is more active in the head of the femur.

In young subjects there may be separation of the epiphysis. The articular cartilage is thrown off and destroyed; but in patients who have been kept much in bed, and not allowed to bear on the limb, this occurrence may be late in the disease. Loose pieces of bone, thrown off by ulceration, are sometimes found in the joint, while the destructive process may be so great as entirely to eat away the head and neck of the femur; yet even in this case dislocation of the femur is no necessity. The flattened surface of the trochanter becomes applied to the acetabulum. The fibrous capsule, at first thickened and softened, becomes distended by pus, and gives way. Pus is sometimes found between its layers; the formation of consecutive abscesses is often simultaneous with ulceration of the capsule. "If," observes Gurlt ('Beiträge zur path. Anat. d. Gelenkkrankheiten,' S. 394), "the capsule becomes perforated at the lower and front part, the abscess forms in the upper and front part of the thigh; if at the posterior part, the abscess forms among the gluteal muscles."

The pus has been known to make its way thus into the pelvis, or to the loins. In some cases it has passed from the hip into the bursa under the pectineus muscle, and thence to the iliac fossa. A case is related by M'Dowd, in which such an abscess communicated with the small intestine, and with the external iliac artery;* another by R. Adams, in which the communication was with the vena cava inferior.†

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* 'Dublin Journal of Med. and Chem. Science,' vol. iv. 1834, p. 9.

† Adams, 'Dublin Journal of Med. and Chem. Science,' vol. iv. 1834, p. 791.

The perforation of the acetabulum is a common occurrence, and abscesses may from this cause make their way either into the rectum, or the bladder, or the vagina in the female. Mr. R. Adams refers to a preparation illustrating this point in the Museum of the Royal College of Surgeons of Ireland.

Dislocation of the femur on the dorsum ilii, in consequence of disease, is less common than once supposed; the shortening of the limb being real, but due partly to the destruction of the head and neck of the femur, partly to the shaft being drawn up in the ulcerated and widened acetabulum. When the anterior superior spinous process of the ilium, the upper margin of the trochanter major, and the tuberosity of the ischium are touched by a straight line drawn from one point to the other, we may be sure that the head of the femur is in the socket; and even when the top of the trochanter is a little above the line, there may be no real dislocation. This latter occurrence is indicated by very marked shortening and eversion of the limb, and considerable deformity of the hip.

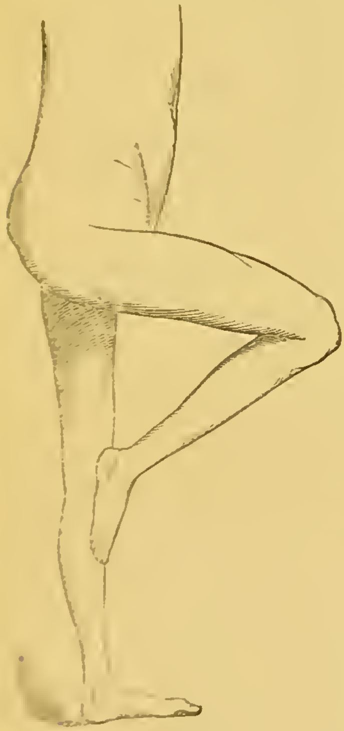

Fig. 6.—Contracted Hip.

In the Museum of St. Bartholomew's Hospital (Ser. II. No. 44) there is a preparation showing dislocation of the femur close on the ischiatic notch after disease: and Portal ('Observations sur la Nature et le Traitement du Rachitisme,' Paris, 1797, p. 313) speaks of dislocation on the obturator foramen.

The limb is shortened, the thigh bent, and turned inwards, and in this position the disease subsides, and repair takes place, not by firm osseous union of the ulcerated bony surfaces, but by fibrous adhesions, assisted in some cases by a spongy osseous growth.

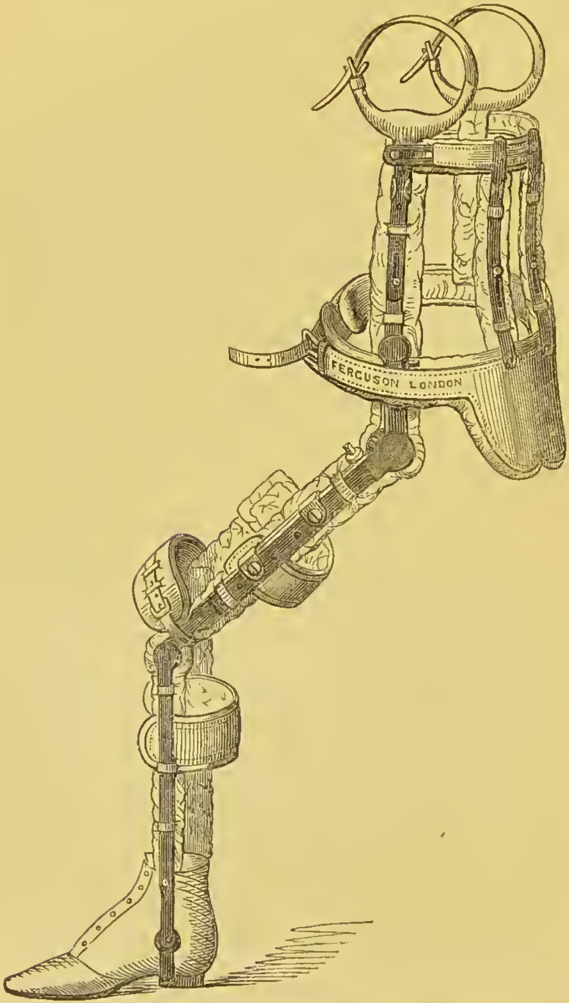

Fig. 7.—Apparatus for Extension of a Contracted Hip.

Strumous disease of the hip is a most tedious and painful affection, but it terminates fatally less frequently than might be expected. The treatment involves well-known principles—rest; the administration of opiates and of tonic medicines; the evacuation of pus; the occasional employment of a gutta-percha case to support and steady the joint. Measures such as these suggest themselves to the mind of every surgeon.

I do not approve of any attempt to straighten the limb until all morbid action has ceased, and the joint is quite free from pain; and then extension should not be rapid and forcible, by which a great amount of injury can be inflicted. But it should be slow and gradual, and effected by means of a proper apparatus.

Acute Rheumatic Disease of the Hip.—This disease, which in the severity of its symptoms, the rapidity of its progress, and uncontrollability of its nature is unsurpassed, is fortunately rare. The following case illustrates its nature. A sailor, forty years old, awoke one night with intense pain in the hip. He felt, he said, as if some one had plunged a dagger into him. The extreme pain lasted some hours, and then continued in a less degree. Some time afterwards he bruised his hip in a fall. After this the pain again became exceedingly severe, and this continued without remission till he died. After death it was found that the cartilage had been completely separated both from the head of the femur and from the acetabulum. Some shreds and ulcerated remnants of it were found loose in the cavity of the joint. The ligamentum teres was destroyed. The exposed bones were superficially but smoothly ulcerated; the cavity of the acetabulum was enlarged by the ulceration of its walls; the capsule was thickened, and the synovial membrane swollen, soft, and slightly covered with lymph.

Chronic Rheumatic Inflammation of the Hip, Malum Coxæ Senile.—*Chronic Rheumatic Arthritis* is a disease, the effects of which are abundantly illustrated by the very perfect series of preparations collected in the Museum of St. Bartholomew's Hospital, and described in the published catalogue of 1846. A most complete and excellent account of the disease has been given by Colles, R. Adams, and R. W. Smith in Ireland. The patient walks stiffly, and with pain, which is the more severe in cold and damp weather. He cannot bend the body forwards from the hips, being unable to stoop, or to sit in the ordinary position; the limb becomes shortened, the leg and foot everted, and the heel raised. The nates are flattened, and the trochanter seems to project unnaturally.

On examination after death, the following morbid changes will be observed:—Specimen No. 8, Ser. II., shows the hip-joint of a man, who for four years had suffered from rheumatic pains in and about the hip. A large portion of the articular cartilage has been removed from the middle of the head of the femur. The bone thus exposed is unnaturally hard; its surface is polished, and the morbid hardness extends for about a line in depth. Of the remaining cartilage, some is softened, thick, succulent, and nodulated on its surface, while that round the margin of the exposed bone is very thin: other parts, again, are marked with grooves, like wrinkles, radiating to the outer margin of the head; and others are converted into a fibrous tissue, which hangs in shreds from the surface of the bone. New bone, in hard irregular nodules, is formed around the margin of the head, and on the neck of the femur.

In No. 20, Ser. II., the acetabulum is greatly enlarged, and has assumed an oval form. The head of the femur is enlarged, and adapted in its form to the acetabulum. All the cartilage is removed, and the surfaces of the bones are smooth, hard, and polished.

The pendulous growths may occupy the whole inner surface of the synovial membrane; many of them branching off from one stem. Gurlt says that in the fresh state there is great vascular injection in their immediate proximity. Under certain circumstances they contain much fatty matter.

The formation of a ridge or ring of bone around the head of the femur, about the trochanters or the margin of the acetabulum, is a remarkable feature of this disease. In many cases we find these osseous "concretions" loose in the joint. In one case examined in the dissecting rooms, I found as many as seventeen pieces of different sizes, varying from that of an almond to that of a pea. That bone which grows from the margin of the acetabulum is true bone; that which springs from the articular cartilage is concretion.

III.—Increased secretion of the synovial membrane (Hydrarthrosis) is a disease, the existence of which has been confirmed by modern surgeons, among whom should be specially mentioned the late Mr. Stanley. When the fluid has accumulated to a certain extent, it makes its way between the acetabulum and the head of the bone, forces the latter out of the socket, when the muscles draw it upwards and outwards on the dorsum ilii. I have seen many cases of this affection in one or in both limbs. It has been observed in St. Bartholomew's Hospital after an attack of rheumatic fever, the dislocation having taken place without the cognisance of the patient. Preparations in illustration of this morbid condition are to be found in the Museum, Ser. II. No. 54, Ser. III. No. 24. Cases, likewise, have been related by Parise, Brodie, M'Dowd, and others.

The condition is quite irremediable. The head of the bone may be drawn down to the socket, but it cannot be kept there. The patient gradually acquires the power of locomotion, but the spine assumes the curvature known by the name of "Lordosis." Some benefit is gained by the use of spinal support. The operations of dividing the contracted muscles about an anchylosed hip, or of dividing by a saw the neck of the femur, and establishing an artificial joint, are proceedings which have not hitherto received the approval of most surgeons.

The earliest excision of the head of the femur was performed by Anthony White, of London, in April, 1822; and of the whole hip-joint by Mr. Hancock, December 6, 1856. "Although," says Dr. Hodges, "excision for injury has been performed but a few times, and with but slight success in saving life, the history of the cases is encouraging, presents a better record than disarticulation, and therefore, as replacing the latter, deserves further repetition. The general results of excision for hip-disease are unfavourably modified by disease of the acetabulum and by efforts to remove this with the gouge; but dislocation of the head of the femur does not appear to exercise much influence either in favour of or against operative interference. Considering the mortality after the operation, viz., one death in every $2\frac{5}{53}$ cases, and the success which follows less heroic methods of treatment, excision for hip-disease does not merit a very favourable verdict."

The Knee.

The knee is very commonly the seat of inflammatory disease. It has, of all joints, the largest synovial membrane, which may communicate with neighbouring bursæ, especially with those under the quadriceps extensor cruris and the tendon of the semi-membranosus. It is exposed to violence, to injury, and, from its superficial position, to the effects of cold and wet.

The articular extremities of the tibia and the femur are broad, and the movements of the limb are constant and complicated.

Let it be remembered that there are but two structures only, of those entering into the composition of a joint, which are the subjects of primary inflammation, namely, the synovial membrane, and the cancellous tissue of the articular extremities of the bones. The frequency of inflammatory affections of the knee is explained by its anatomical conformation. As regards synovitis, about 80 per cent. of all cases attack this articulation.

Acute inflammation of the synovial membrane may ensue from cold, violence, or other causes in a knee previously healthy; or it may supervene in cases where the component structures have already undergone changes from chronic disease. The symptoms and progress of the two present some important points of difference.

In the former case the symptoms are more acute, the accompanying febrile disturbance is greater, the synovial cavity is more tightly distended, and there is greater risk of complete destruction of the joint by suppuration. In the latter the inflammatory excitement is less, the accompanying fever more moderate; the synovial cavity is rarely very much distended, and examination conveys to the hand the feeling that the synovial membrane itself is thickened.

The importance of promptly arresting the inflammation, in either instance, cannot be over estimated. The lateral ligaments soon become softened, and permit a displacement of the bones of the leg, which greatly weakens the limb; but the morbid condition of the bone must never be neglected.

There is scarcely any contingency which can justify the surgeon in making an opening into the knee-joint, except in the case of acute suppuration, or of the removal of a "loose cartilage."

The following case is remarkable:—John Q., aged 42, was admitted into St. Bartholomew's Hospital April 23, 1863, suffering from acute rheumatic synovitis of the right knee. Under proper treatment, the symptoms were subsiding, when on the 18th May he complained of constriction of the throat, and inability to swallow food. At the end of three weeks he felt, to use his own words, something burst internally, when he brought up from the throat about a tumblerful of fluid, the first part like the yelk of an egg, the latter part more purulent. He was immediately relieved of the more distressing symptoms, and he finally recovered.

Abscesses external to the knee-joint are generally recognised by their situation and relation to the patella and ligaments; by their form; by the redness of the integument; by the sense of fluctuation, which differs from that of a joint full of synovia. They are not uncommon, and should always be opened early lest they burst into the cavity of the joint. A young woman is at the present time under my care, in whom there was abscess on both the outer and inner side of the knee; and the presence of these purulent collections seemed to keep up the inflammatory excitement of the synovial membrane. After the pus had been let out, the joint-disease became comparatively manageable. Many surgeons seem to dread opening an abscess in the proximity of a joint, for fear of wounding the synovial membrane.

I have never known such an occurrence when ordinary precautions have been observed. After wounds of the knee, synovitis ensues, accompanied almost invariably by suppuration in the limb, and early incisions are indicated; but suppuration may mask for a time the disease of the synovial membrane.

I opened, in a child aged four years, an abscess on the outer side of the knee, extending into the popliteal space, and containing between six and seven ounces of well-formed matter, 10th September, 1863. During the next two hours as much discharge again came away in the poultice, amounting to about fourteen ounces in all; after which the discharge gradually ceased, and the child was relieved of urgent symptoms. But the leg remained in the bent position ; and as the swelling subsided, we noticed the puffy and swollen state of the synovial membrane, projecting on either side, and above the patella. He remained for eight months in the hospital, and left it relieved, but by no means cured. The leg was semiflexed ; the synovial membrane thicker than natural.

The apparatus by means of which we effect the extension of the knee must of necessity be strong and heavy, so much so that patients are often at first but little inclined to wear it. But a lighter instrument is of no avail : it bends or breaks under the resistance offered, and no improvement is effected in the limb. In by far the greater number of cases the tibia and fibula are drawn backwards and outwards, and no power which we at present possess is sufficient to replace them entirely. Something may be done by the pressure of pads and straps, but the deformity is permanent.

William B., æt. 49, an unhealthy-looking man, accidentally punctured his left hand. Inflammation of the hand and forearm ensued, requiring several openings by the lancet. He recovered, the hand not being much damaged, when inflammation ensued in the right knee-joint, with effusion into the synovial cavity. Then chronic thickening of the synovial membrane supervened, which increased until it involved all the other tissues, including the skin, and communicated the feeling of fluctuation. Fistulous passages leading into the interior of the joint next formed; and on one of these being laid open, the peculiar light-brown coloured degeneration of the synovial membrane was exposed. The parts above and below the joint were hard and brawny. Amputation was recommended; but the patient, who was also suffering from tuberculosis of the lungs, withdrew to his friends.

The partial dislocation of the bones of the leg backwards and outwards, with slight rotation and partial flexion of the limb, does not destroy its utility. As is shown in a specimen (Ser. II., No. 55), firm anchylosis, by fibrous tissue, takes place between the upper surface of the tibia and the condyles of the femur. The patella becomes anchylosed to the outer condyle of the femur; the external and internal lateral ligaments, much elongated, retain their normal attachments. I have often succeeded in putting such a limb straight by the help of proper apparatus. In some cases the osseous union of the patella may be broken through; the hamstring tendons may need subcutaneous section. Some amount of forcible extension may be required; but the last measure is not always safe.

The apparatus for extension is represented in the woodcut, page 86.

It rarely happens, when the bones of the leg become displaced at the knee after disease, that the deformity is limited to simple flexion of the leg on the thigh. There is usually rotation of the tibia and fibula outwards, these bones being also drawn backwards more or less into the popliteal space. In other instances genu valgum, or knock-knee is combined with the preceding, the foot being directed outwards, the toe usually pointing downwards. In every case there is more or less flexion of the knee; for in that position only are the articular surfaces so applied as to permit of either abduction or outward rotation. Rotation of the bones of the leg outwards is effected by the action of the biceps muscle on the head of the fibula, assisted by the tensor vaginæ femoris, which acts on a strong band of the fascia of the thigh, extending downwards to the leg. If we except the deformity called knock-knee, these malpositions of the bones are not caused by the act of standing, nor of walking, nor moving in the bed. Flexion of the limb at the knee relaxes the ligaments, especially the lateral ligaments, and relieves the joint, which is sensitive to pain from pressure of the articular surfaces one against the other. On this account, the surgeon does wrong to endeavour, while disease is still going on, to force a limb straight: he tries by such means to put it into a position which the patient will not be able to bear. When disease has subsided, he may then with safety avail himself of apparatus to render the limb useful as a simple column of support. In order to recognise the amount of abduction of the bones of the leg, the patella must be brought directly forwards; the line of direction of the bones of the leg, and the distance of one heel from the other, will be then perceptible. The means which we employ to put a contracted knee straight are—1. Forcible extension. 2. Gradual extension. 3. The subcutaneous division of tendons. Let me repeat that none of these measures are applicable until all morbid action in the joint has come to an end. There must be no heat nor swelling. The parts must be simply in an abnormal position.

Dec. 1, I saw a pallid, slightly-built, and delicate boy, aged ten, with contraction of the left knee at right angles, following a fall six years previously. The joint, however, was not the seat of severe disease; the outlines of the patella and femur were clear and defined, but the head of the tibia was enlarged to three times its usual dimensions. Although he had not suffered while in the hospital, where he had the advantage of good diet and complete rest, yet before his admission he experienced extreme pain in attempting to use or to bear upon the limb. This was especially severe for the first two years succeeding the fall. About that time an abscess formed and burst, and has continued to discharge up to the present time. In such a case extension was obviously improper as a premature measure. The patient was therefore sent to a convalescent hospital.

In 1864 I saw a little girl in whom an apparatus for extension was applied at a time when the synovial membrane was still thickened, and the joint was hotter than natural. Every attempt at extension had failed. After a certain amount of pressure, the joint became acutely tender and much enlarged, and finally presented many of the appearances which, in the minds of some surgeons, justified the operation of resection. No operation, however, was performed. Time and rest ultimately allowed all morbid action to subside; and then the bones were brought, without much trouble, into a straight line. In these cases, too, there is often some amount of motion left.

Forcible extension is applicable only to those cases in which, after an attack of rheumatic inflammation, or after some accident to a healthy individual, a band or deposit of osseous material prevents the gradual extension of the contracted limb by means of proper apparatus. And, then, we are not called upon to drag out the limb straight at once; we should rather content ourselves with overcoming the immediate obstacle, and afterwards trust to more gradual measures. If we tear asunder the parts which have been formed to repair a disorganised joint, we damage that which we require for the consolidation and support of the limb. In 1853 I had the opportunity of forcibly extending an amputated knee, in order that I might see the effect produced. The crucial ligaments were torn, and with them were

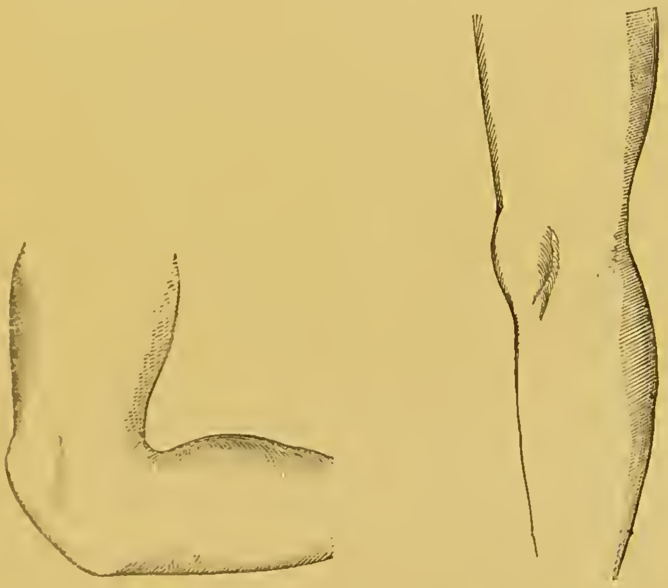

Fig. 8.—Contracted Knee. Limb extended by treatment.

separated a few remaining fragments of articular cartilage; portions of cancellous bone from the tibia were loose in the remains of the joint, and various adhesions were lacerated. Although such injuries admitted of repair, yet they were unnecessary, and would have retarded the patient's recovery.

In 1859, I broke through an osseous band in the case of a young girl of eighteen, whose knee had become contracted in consequence of one attack of rheumatic inflammation. A sharp sound was heard, and the limb at once became movable; but I then desisted from making any further effort, and, by means of graduated extension, put the joint straight in six weeks.

Woodcut, page 86, represents the apparatus used. The plates were broad and the straps wide; the whole apparatus fitted well and was strong. The surgeon's patience and resolution must never fail him, and in time he will feel surprise at his own success. It is unfortunately a practice among some to underrate the slow processes by which such cases are managed; but the principle is true for all that. Just so great or small an amount of extension as the patient can bear without pain, repeated at proper intervals every second or third day, will yield a larger result at the end of six months than any act of violence or force.

The division of the hamstring tendons is rarely necessary in young children. In grown-up persons the hamstring tendons generally need the operation of subcutaneous tenotomy. The operation can be performed without difficulty. The danger of wounding the peroneal nerve must be guarded against by keeping the knife close to the biceps tendon. After the division of the tendon, any fibrous bands which remain yield readily to extension; but the nerve, if divided, will reunite after a time, and its function will be completely restored.

Among the poor, the great evil which they have to overcome is the necessity for constant exertion: they cannot rest; hence morbid changes are constantly excited.

A spare-looking woman, æt. forty, married, became affected with rheumatism in the early part of 1863. She was attended by a surgeon, who administered the usual remedies. During the course of the disease she experienced severe pain in the left knee; but by rest and suitable applications the joint got into a quiet state, and she was able to move the limb. Shortly afterwards the knee again became painful, when she came under my care, complaining of starting pains in the articulation, so severe as to deprive her of rest. Nov. 2, 1863, morphia was administered; blisters were occasionally applied. The pain, however, increased. I found that the patient made a point of "getting up daily to have her bed made." The symptoms increased in severity in spite of every treatment, and the limb was amputated, Nov. 23, 1863. *Examination of the Limb.*—The synovial membrane was more injected than usual, but was not materially thickened. Upon its exterior was an abundant deposit of fat, two inches in thickness, the fat being fine and granular, of light grey colour, and deposited among a sparing fibrous basis. The interior of the joint looked moderately healthy, but the internal semilunar cartilage was destroyed in its anterior half. The articular cartilage throughout was thinned at its margin: in parts it was removed. At the inner condyle of the tibia there was a semicircular ring of denuded bone, from which a quantity of highly vascular granulations arose; for a considerable distance, and especially towards the posterior part of the joint, the cartilage was so loose that it could be easily "peeled off." The same was observed, but in a less degree, on the under-surface of the internal condyle of the femur. The ligaments were becoming softened.

I do not affirm that this limb might have been saved, but what chance was there of improvement under the circumstances in which the patient was placed? Determined to get out of bed, and sit on a stool with crossed legs every day, she suffered so much that it took her forty minutes to get into bed again; and during this time, doubtless, more injury was inflicted on the diseased joint than forty-eight hours of rest were able to repair. Hence her progress from bad to worse.

In aged persons who have become stout and heavy, the knees are apt to bend outwards and produce a very unsightly appearance of bow-legs. This is followed by uncertainty of gait in progression and a tendency to fall. I attended a gentleman so affected, some years ago, who found the inconvenience so great that he feared to leave his house alone. An apparatus partially rectified the deformity, but it gave him immediate relief and enabled him to follow his daily avocations with comparative ease. Iron supports were placed on the concavity of the curve. The apparatus was heavy, and abundantly supplied with straps; but the answer to all objections was the patient's own confirmation of the comfort which he derived from its use. I have seen him on several occasions since, and his powers of locomotion improve.

I am no strong advocate for the operation of resection of the knee-joint under any circumstances, and disapprove of it almost unconditionally in children, in whom the limb afterwards becomes year by year weaker, more withered, and less equal to the opposite member. Dr. Hodges considers that the small degree of success following the few cases of excision performed for traumatic causes does not warrant inferences favourable to its future adoption as a substitute for amputation. In cases of disease, one death occurs in every $3\frac{7}{15}$ operations. Therefore, "although occasionally yielding brilliant results," it is an operation to be practised with great reserve. Partial operation upon the knee, as in other ganglymoid joints, adds materially to the number of unfavourable cases. Inasmuch as the non-removal of the patella converts the excision into a partial one, this bone should never be allowed to remain.

Resection among the young has its unsatisfactory aspects. On February 14th, 1863, one of my colleagues amputated, at St. Bartholomew's Hospital, the left thigh of a boy, aged twelve, who had undergone the operation of excision of the knee-joint in another hospital, in consequence of scrofulous disease of the articulation, about nine months previously. The condition of the boy before the second operation was as follows. He was not much emaciated, nor had his face lost all trace of the usual florid colour. The left lower extremity was an inch and a half shorter than the opposite; the thigh was hot and swelled; sinuses led from the incisions about the knee to dead or denuded bone. There was some mobility at the knee, the limb was utterly useless, and the opinion was general that the sooner it was removed by amputation the better. Upon making the usual incisions it was found that the tissues were much infiltrated, and some considerable sinuses extended upwards among the muscles of the thigh. The hæmorrhage was troublesome, in consequence of the generally increased vascularity of the limb. The wound ultimately cicatrised, and the boy left the hospital well, and able to walk about on an artificial limb. The examination of the amputated parts, including the seat of the resection, was full of interest. In the first place, very little of the bony surfaces of the tibia or femur had been cut away at the time of the resection: their usual outline remained; therefore, although the epiphyses had been left, arrest of development was still a consequence of the operation. Secondly, the greater part of the synovial membrane was left behind in a thickened, discoloured, and pulpy state, keeping up the effects of disease in full activity. Thirdly, there were numerous scrofulous abscesses in the popliteal space. Fourthly, there were two or more points where the surface of the tibia was in a state of carious ulceration, or of necrosis. Fifthly, the union between the tibia and femur was incomplete, being partly fibrous and partly osseous; but the bone was dark-coloured, soft, soddened, and spongy, and unsuited to effect firm union. Sixthly, the opposed surfaces were not in proper rectilinear apposition.

Could any result have been less satisfactory? But, it may be said, such cases are exceptional. I am not prepared to acquiesce in that statement. In December, 1862, another surgeon amputated the left lower extremity of an infant on whom excision of the knee-joint had been performed a year before in another hospital; and a third case occurred in my own practice, in which the parents declined any further operation, although the limb was short, withered, and useless, and the child could walk only with the aid of crutches.

We are told that excision of the knee-joint is a less fatal operation than that of amputation of the thigh; but Dr. Hodges observes in his essay 'On the Excision of Joints,' "Out of a considerable number of cases one-third died, more than one-third are known to have failed, and there is no direct evidence of success in more than one-third of the cases, even accepting the statements of those who furnished the notes."

Loose Cartilages and Internal Displacement of the Semilunar Cartilage.—"I feel," observed a patient to me, "as if at a moment the whole limb, from the knee downwards, was numb. If I press on some movable body when it has slipped to the outer side of the patella, a sharp pain runs down to the three outer toes. If I press on the body when it has slipped to the inner side, the pain extends to the great toe and the toe next to it. The pain is that of a sharp knife which cannot cut its way out." In this case the application of a stiff knee-cap afforded immediate relief. Displacement of cartilage is supposed to depend on a subluxation of the *external* semilunar cartilage. It cannot be the internal, inasmuch as this latter is half-moon shaped and fixed by both extremities to the bone, and by its middle to the internal lateral ligament. The external semilunar cartilage, on the other hand, forms nearly a complete circle, and is attached only at that point where its two extremities meet. In order to put the part right when displaced, first bend the knee to relax the ligaments and then sharply extend; the articular surfaces of the joint coming together press the cartilage into its proper position.

Abscess External to the Joint.—It may be well to mention that abscesses sometimes form in the ham, independent of any disease of the knee-joint. I have had many such cases in servants and working people, generally young. A. J., aged twenty-four, was admitted into St. Bartholomew's Hospital with an abscess in the ham, and with eruptions of an undefined character over the trunk and upper and lower extremities.

He was a healthy-looking man of light complexion, and was admitted on May 22nd, 1862. Had been formerly a clerk in an Assurance Office, but had been out of employment for six months before his admission. He was accustomed to good living, regular in his habits, and not addicted to drinking. About April 17th he first noticed an eruption breaking out over his legs of a pustular character, the pustules varying in size and form from a pea to a sixpence, of a reddish-brown colour, elevating the cuticle, and discharging a gelatinous yellow-coloured substance, with a feeling of great heat. Before the end of the month they had spread all over the body, still varying very much in size and also in colour. The larger pustules left an excavated sore, long in healing. Seven years ago he had suffered from gonorrhœa, and in 1858 from syphilis, followed by sore throat and other secondary symptoms. May 10th. —He first noticed a redness near the bend of the knee of a painful character and impairing the action of the hamstring muscles. On the 22nd he was admitted, and four days afterwards the abscess was opened by a free incision, giving great relief. About ten ounces of matter were discharged, of a healthy appearance and void of smell; a linseed poultice to be constantly applied. 27th.—A senna draught was ordered to open the bowels; complained of pain during the night, but was easy during the day; the eruption gradually leaving the trunk and lower extremities. June 4th.—The abscess continued to discharge very freely; patient on full meat diet, with beef-tea for supper: a pint of porter, arrowroot, and pudding; pulse from seventy to seventy-eight, but very changeable and with but little force. 7th.—Abscess still continued to discharge abundantly. 8th.—Another abscess formed below the old one, not defined, but extending over a large surface; a linseed poultice ordered to both; the eruptions entirely left the body except a few scars on the arms; health very good. 12th.—Convalescent.

Hypertrophy of Muscles of the Calf.—Among the causes of contraction of the knee is one which is not often mentioned, namely, congenital hypertrophy of the muscles of the calf, with a corresponding amount of shortening. It is obvious, under such circumstances, that either the heel must be raised or the knee bent. On March 1st, 1858, I saw, in conjunction with another surgeon, a case of this description. The measure proposed was division of the tendo Achillis, and this operation was performed at a later date. The result of the case I never witnessed, but it was reported to me to be favourable. I have operated in similar cases myself.

Displacements of the patella are usually outwards, and are frequently associated with curvature of the bones. Sometimes they are met with in the opposite direction. I saw, in 1860, a short but healthy-looking, though somewhat hysterical girl, aged twenty-three, in whom there was anterior curvature of the femur; anterior and outward curvature of the tibia; and projection of the head of the fibula. These changes in form were clearly due to rickets in early life. The effect upon the joint was, in the first place, loosening of the external lateral ligament; secondly, an undue amount of mobility in the joint, with great weakness of the limb. But the great complaint made by the patient was of partial dislocation of the patella *inwards*, and a certain amount of flatness of the sole of the foot, so that, in bending the knee, she was liable to a sudden slipping of the bone and a tendency to fall, while the state of the foot caused her constantly to feel tired. Unfortunately, in this case nothing further could be done than the adjustment of a well-made knee-cap and properly made boots for the feet. I saw a similar case with my colleague, the late Mr. Stanley.

Michaelis ('Deutsche Klinik,' 5, 1859) relates two cases of congenital dislocation of the patella.

The Ankle-Joint.

Just as the lower end of the femur or the head and lower extremity of the tibia are prone to disease, induced by shocks and other injuries transmitted by the weight of the body, so do the os calcis and the astragalus suffer, though more rarely, at the ankle-joint. Some of the morbid appearances are illustrated by the following case:—William T., aged 14, a delicate boy, underwent the operation of amputation at the lower third of the leg, in consequence of disease of the ankle, induced by a fall, June 10, 1848. On examination of the morbid parts, it was found that the integument was thickened, and that a fistulous passage extended right across the ankle-joint, the external openings being below the malleoli. The tendons were normal, but the thecæ were thickened. Under a quantity of dense and firm tissue lay the os calcis, denuded of periosteum, black, and rough. The old cancellous texture appeared to be mortified, and in process of separation from the outer layer. Some fragments were loose, and of whiter colour than the rest. The other bones of the foot presented no abnormal appearance, except that they were light and soft, the outer wall thin, the interior filled with a thin oily fluid, the cartilages partially absorbed; such changes proceeding from want of employment of the limb. The calcaneo-astragaloid articulation was entirely destroyed. I have seen other similar cases, mostly in young subjects. In one, a piece of the os calcis as large as a filbert had mortified and exfoliated, and made its way externally through a fistulous passage. In another the bone had wasted away in minute fragments by the discharge. Mr. Stillman relates a case of caries of the os calcis following a bruise on the heel. The patient had been previously treated for tubercular disease of the left lung in an early stage. Nearly the whole of the cancellous tissue of the bone was gouged away through an incision below, and rather behind the external malleolus. The wound healed perfectly.* Mr. Erichsen mentions the particulars of a case in which the disease involved the os calcis, astragalus, and cuboid bones. He endeavoured to remove the diseased parts, but finally amputation of the entire foot was necessary.† There is a specimen of disease of the ankle-joint from a young man aged 18 (Museum of St. Bartholomew's Hospital, Ser. II., No. 46) showing purulent infiltration of the whole spongy substance of the tibia in consequence of acute inflammation. The ulceration extends to the knee-joint as well as to the ankle; also there is suppuration between the epiphysis and diaphysis: the periosteum is separated from the bone in nearly its entire length, and is very vascular and thick, and on its inner surface pulpy and velvety. The articular cartilage is nearly entirely removed from the astragalus, and the denuded bone is covered by a layer of fibrine.

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* 'Lancet,' April 16, 1859.

† Ibid., June 18, 1859.

Of the bones of the foot, the os calcis is the most exposed to injury. A nail may be driven accidentally into it, producing inflammation and necrosis of its cancellous tissue, combined with abscesses in and around the bone. Ulceration is apt to extend through its superior surface, destroying the articulation between it and the astragalus. Such a case would be tedious, and involve much suffering; but with time and rest it might end in anchylosis between the affected bones. This event is illustrated by a preparation in the Museum of the Hospital (Ser. II., No. 243). In another specimen (Ser. II., No. 169) there is anchylosis between the os calcis and the os cuboides.

I remember a case under the care of the late Mr. Stanley. A sailor fell from the rigging of a ship on the deck; he alighted on his feet. The weight of the body and the shock was transmitted to the head of the astragalus, which became diseased. The foot remained swollen and painful, and he was unfit for active employment at the period when he left the Hospital.

The articulations composing the foot and ankle are less frequently the seats of disease than the larger articulations of the knee and hip. The instances are mostly those of strumous disease of the bones in the young, and of gouty deposits in the aged. Surgical operations are rarely needed in either case. In strumous disease it is scarcely possible to determine the limit between diseased and healthy bone, until Nature has marked the boundary. Cases of gouty disease come to a natural termination by the fibrillation and removal of the articular cartilage, and the deposit of urate of soda upon the denuded surface of the bone. In cases of blood-poisoning pus has been found in the ankle-joint, also the separation of the epiphysis from the diaphysis. M'Dowd relates the case of a boy, aged 12, in whom the synovial membrane of the left ankle was inflamed and covered with a brownish-red pus. The epiphysis of the lower end of the tibia was completely separated, and the periosteum of the entire tibia was separated from it, inflamed, and thickened. The right hip-joint was diseased in a similar way.*

But the diseases are for the most part of more chronic character. The foot is swelled, especially about the malleoli. Abscesses form, which discharge either a thin pus or a thicker fluid, mixed with flakes of dead tissue and tuberculous deposit. Sinuses form, which lead down to bone; and this condition in young subjects will last for several years; but in the end children, almost without exception, do well, if placed under circumstances at all favourable for recovery. The great danger which they run is from surgical interference. It is said that such a part is "spoilt," and parents lose heart and listen to the suggestion for operation. My advice is patience. The patient can walk on a common wooden leg, the limb bent at right angles, so that the foot never touches the ground. By such means exercise may be taken, and health preserved, and Nature in due time perfects the processes of repair. But when once a wound is made, it usually gapes, and will not heal; the discharge becomes abundant, the swelling greater, and the general condition is rendered more unfavourable.

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* 'Dublin Journ. of Med. and Chem. Science,' vol. iii., 1833, p. 386.

Inflammation of the ankle-joint very frequently involves more articulations than one. Commencing in the astragalus, it may spread both to the surface opposed to the tibia and to that connected with the os calcis and the os scaphoides. In strumous subjects a morbid condition of the bones, rendering them soft and friable, often involves the tarsus and metatarsus, and renders it impossible for the surgeon exactly to localise the disease. In almost all cases of this disease the foot is flattened, and the inner ankle projects; so that the patient may need, when all morbid action is passed, a boot with outside iron and a strap, and a small pad to restore the arch. The synovial membrane may be the structure chiefly affected, in which case a soft swelling projects in front of the joint, traversed by the extensor tendons. In chronic cases all the surrounding tissues become infiltrated, the muscular structure is pale, and the tendons soft; and the patient cannot bear to touch the ground with the foot.

That disease, however, known as "disease of the joint," may attack the ankle. Spec. 1, Ser. II., Museum of St. Bartholomew's Hospital, exhibits the section of an ankle-joint, showing the effects of inflammation spreading from the bone. The articular cartilages are completely destroyed, and the bones are superficially ulcerated and vascular. Such cases, especially when they occur in the adult, usually demand amputation. The process of repair goes on unfavourably in the ankle, and osseous union of the bones is exceedingly rare. The patient finds the diseased limb a burden to him, and becomes restless from the restraint and confinement which it imposes.

This state of the cartilage and bone differs materially from the atrophy following long disuse of the limb. In the same series there is an astragalus, from the superior surface of which nearly all the articular cartilage has been removed; a small portion remains closely adherent to the bone, and very thin. The exposed surface of bone is healthy, except at one small portion which is superficially ulcerated.

Of gouty deposits there are numerous specimens. The following show the usual morbid appearance :—

Specimen 10 (Ser. II.) exhibits an instance of gouty deposit. It consists of the os calcis and astragalus of an aged gouty person; the articular surfaces are uniformly covered by a thin deposit of white earthy matter, consisting principally of carbonate of lime. The cartilages themselves are thin.

Specimen 11 (Ser. II.) is that of a patella, the cartilage of which is whitened by the deposit of earthy matter. It appears also thickened and nodulated. Both this and the preceding specimens were taken from a man between forty and fifty years old. Nearly all the joints in the body were in a similar state; in some, a portion of the white substance was in a fluid state, and around some there was a similar deposit in the adjacent tissues.

Specimen 33 (Series II.) exhibits the articular portions of two ossa femoris, and of two patellæ, from the same individual. A deposit of white earthy matter, the effect of gout, has taken place upon the surface of their articular cartilages.

Numerous other observations are to be found in the works of pathological authors. The digestive function is disturbed by causes either hereditary or acquired; the blood becomes loaded with materials, which the kidneys cannot void sufficiently quickly, and hence they are deposited, among other places, in the joints.

The great difficulty in obtaining the osseous union of the bones of the ankle-joint after disease is a fact which long ago attracted the attention of the late Mr. Stanley. I accidentally found one instance, but without history, in the dissecting room; but we have no other similar specimen in the Museum.

We sometimes meet with cases of fracture of the astragalus. A man was under the care of the late Mr. Vincent in St. Bartholomew's Hospital, with fracture of the astragalus from a fall. He alighted on the flat of his feet, and broke the astragalus at its neck. On examination, it was found that he was flat-footed. A woman, aged 40, who had suffered severely from chronic rheumatism, was under my care in the same Hospital for compound fracture of the tibia and fibula, caused by slipping off a small dust-bin about four feet from the ground. We found the calcaneo-scaphoid ligament had completely yielded, and that the head of the astragalus was broken on the sole; so that the arch of the foot was lost, and with it the springiness which enables us to moderate sudden shocks and concussions in movements. Many similar cases might be quoted.

Excision of the ankle-joint, in compound dislocation, is an operation which often successfully replaces amputation. It is, however, followed by a large proportion of failures, 43·75 per cent. of all operations. "Under such circumstances," says Dr. Rodger, "and in view of the facts that disease of the tarsal bones is insidious, apt to re-appear, and its entire removal a matter of uncertainty, this excision ought to be of infrequent performance." The sawing off of the end of the tibia after certain accidents cannot be regarded in the light of a "re-section." Moreover, it is an operation of antiquity, and scarce merits a place here. The extirpation of the astragalus has been successfully accomplished; also the removal of the os calcis. Sequestra have been removed from the metatarsal bone of the great toe. But operations on the foot for strumous disease usually yield unsatisfactory results.

CHAPTER VIII.

DISEASES OF THE TEMPORO-MAXILLARY ARTICULATION AND OF THE SPINAL COLUMN.

Diseases of the Articulation of the Lower Jaw.—The Museum of St. Bartholomew's Hospital has one specimen of ulceration of this articulation. The right glenoid cavity is greatly enlarged by ulceration, which has spread both widely and deeply in the adjacent bone, and new bone is formed around this ulcerated surface. This proceeded most probably from rheumatic inflammation. In the Museum of Guy's Hospital there is a specimen (No. 1070) in which complete osseous anchylosis has taken place.

In the Museum of St. Bartholomew's Hospital, Subseries A., No. 87, there is the following:—"A skull with the lower jaw; many distinct portions of the cranium have been removed by ulceration, like that consequent on the growth of tumours. In some situations the absorption is confined to the diploë and outer table of the skull; in others it extends through both tables. There has been disease in one of the articulations of the jaw, producing absorption of the articular cartilage, with a deposit of bone in the circumference of the glenoid cavity. The corresponding condyle is in part removed by absorption; its surface is rough, except at one point, where it is highly polished and has an ivory-like texture.

In the ramus of the jaw on the same side, disease, apparently commencing in the diploë, has produced absorption of the bone at many separate and minute points." This was in all probability a case of diffused suppuration of bone, produced, it may be, by the maladministration of mercury.

The disease of the jaw produced by the fumes of phosphorous acid properly belongs to the subject of diseases of bone. We have in the Museum of the Hospital a very complete series of specimens illustrating its effects. It would seem that the phosphorus generally acts on the jaw through the exposed socket of a carious tooth; thus it destroys the bone, exciting, however, a peculiar inflammation of the periosteum, which separates, leaving on the surface of the jaw a velvety product of new bone. I have removed in such cases nearly the whole jaw, and the same operation has been done with equal success by others. The periosteum being left, a new production of bone takes place, giving to the patient a sufficient amount of firmness to masticate, and preventing any remarkable deformity. The same disease has been witnessed, but more rarely in the upper jaw.

This velvety deposit of new bone on the necrosed portion is a constant condition, and constitutes an important point of difference from ordinary specimens of necrosis. The disease is reported to have attacked others of the cranial bones than the upper and the lower jaw.

The Vertebral Column.—Diseases and deformities of the vertebral column are mostly grouped under the two great divisions of angular and lateral curvature. The former is dependent on caries and softening of the bodies of the vertebræ, and sometimes cancerous infiltration;

the latter on weakness of ligaments, followed by compression and partial absorption of the bodies of the vertebræ, which are generally lighter than natural, and not uncommonly deformed. Other morbid changes, such as rigidity of the spine from ossification of its ligaments and the growth of osteophytes; tumours of various kinds; absorption of bone from the pressure of an aneurism; scarcely come within the scope of "diseases of joints."

In extreme cases of mollities ossium, the lower part of the occipital bone has been pressed inwards towards the cranial cavity, so as to diminish the vertical diameter of the skull. In some of these cases the atlas has been found united by bone to the occiput.*

Cervical Region.—Inflammation of the articulations between the two first cervical vertebræ and of the joints which unite them with the occipital bone differs from disease of similar character attacking other vertebræ in this respect, that it is very often attended with dislocation of a single vertebra; and in consequence of such displacement a very remarkable narrowing of the vertebral canal ensues, attended with compression of the medulla oblongata and upper part of the spinal chord. It is also to be noticed in these cases that, for the most part, the articulations between the occipital bone, atlas and axis are simultaneously affected, and that the disease is limited to this region.

Thus in the Museum of the Hospital (Ser. IV., Nos. 26, 27, 28, 29, 30) we find specimens showing the occipital bone and the anterior half of the atlas firmly and completely united by bone; the second and third vertebræ similarly anchylosed at their articular processes. The changes seemed to have followed ulcerative disease, by which the odontoid process and the body of the second vertebra were changed in structure and in part removed. In another specimen the atlas is displaced towards the left side, and its right half, projecting within the foramen magnum, considerably diminishes the size of the aperture. A yet more remarkable specimen has been described by Mr. Paget in the 32nd volume of the 'Transactions of the Royal Medical and Chirurgical Society.'

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* Lobstein, 'Traité d'Anat. patholog.,' t. i. p. 65; and Atlas, Pl. ii. Fig. 1. Ed. Sandifort, 'Exercit. academ.' Lib. I. p. 6, Tab. 1. Fig. 2.

The ligaments and the tissues surrounding the articulations of the spine are sometimes found infiltrated by a lardaceous fungous exudation, while the articular surfaces are not much altered and the cartilage is still adherent. In these cases we have reason to suspect the existence of primary inflammation of chronic character affecting the bone. The arches of the vertebræ are often ulcerated, and have in some instances been entirely destroyed, so that the spinal chord has been left unprotected to a greater or less extent. In specimen 22 (Ser. IV., Museum of the Hospital) the left half of the arches of the fifth, sixth, and seventh cervical vertebræ are almost completely destroyed. A portion of the ulcerated bone has become separated and has pressed upon the spinal chord; the remaining portions of the bone are of their natural texture.

The bodies of the vertebræ are more often the seat of ulceration, both tuberculous and syphilitic. Autenrieth* describes a case in which syphilitic ulceration of the pharynx spread to the spine and completely destroyed the bodies of the three upper cervical vertebræ, the spinal chord being exposed to the cavity of the mouth. In these cases consecutive abscesses form, but differ much in situation. Thus they may present in various parts of the neck, in the neighbourhood of the ear, and even, by fistulous openings, in the face. They are mostly to be found in front under the deep muscles of the neck, or pressing against the wall of the pharynx (retro-pharyngeal abscess).

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* Autenrieth, in 'Tübinger Blätter f. Naturwissenschaft u. Artzneikunde,' B. ii. S. 2. 1816.

The matter has been known to make its way into the vertebral canal, raising the ligamentum commune posterius, and pressing upon the chord. In other cases the collection of matter presses in the pleura. Such an occurrence was noticed in a child, ten years of age, in whom, after death, there was found complete destruction of the bodies of the fifth and sixth cervical vertebræ, and partial destruction of those of the fourth and seventh. The intervertebral ligaments between these vertebræ, as well as those between the four first dorsal vertebræ, were completely destroyed, and the bodies of the dorsal vertebræ were superficially ulcerated. Angular curvature existed in the lower part of the cervical region, where the remains of one of the bodies of the vertebræ projected far into the spinal canal.

The odontoid process, when affected, is generally ulcerated at its base.

A remarkable case of ulceration of the vertebræ has been recorded in the records of the Hospital Museum. A woman, thirty-two years of age, suffered for the space of four years from a constant acute pain at the back of the neck, just below the occiput. She had some difficulty of swallowing, and used to sit with her chin on her hand, or resting on her sternum; but she suffered no loss of sensibility, and was able to walk on the day before her death. Upon examination it was found that in the dorsal region the anterior parts of the bodies of four vertebræ were ulcerated. A large portion of one of the vertebræ, including one of its intervertebral cartilages, was destroyed, and angular curvature had been produced. The remaining osseous tissue appeared healthy. The periosteum, thickened, indurated, and united with the pleura, was separated from the surfaces of the diseased vertebræ. In the cervical region the connexions between the first and second vertebræ and the occipital bone had been destroyed by ulceration; the anterior portion of the first vertebra and the basilar portion of the occipital bone had sunk down, so that the lower margin of the first vertebra was within a line of the upper margin of the intervertebral substance between the second and third, and the whole of the odontoid process of the second projected straight upwards into the cavity of the skull. The medulla oblongata was thus lifted up and stretched over the apex of the odontoid process, and as the pons held its connexion with the basilar portion of the occipital bone, the axis of the medulla oblongata formed a right angle with the axis of the spinal chord. The displaced bones were held together by the thickened and consolidated adjacent tissues. Their texture appeared indurated, but not otherwise diseased.

The occipital bone may be dislocated consecutively from the atlas in the directions backward, forward, or from side to side. Dislocation backwards has been described by Lawrence,* Nichet,† and others; dislocation forwards by Ollivier.‡ Most of these dislocations have a lateral or twisted inclination.

The atlas may be dislocated from the axis directly forwards, or from side to side.

Many of these conditions are recognisable by diagnostic symptoms during life, and are in some respects amenable to treatment. This part of the subject must be deferred until the morbid changes in the other regions of the vertebral column have received consideration.

Dorsal and Lumbar Regions.—That part of the spinal column most commonly the seat of caries is either the lower dorsal region, or the junction of the dorsal and lumbar, where the movements of the spine are most free, and possess, indeed, almost the range of a ball and socket-joint. But, as already shown, caries may be met with in the cervical region, or in two or more regions in the same subject.

Caries, which is an unhealthy ulceration of bone, may be superficial or deep, acute or chronic. In the case now under consideration it is mostly the deep variety; but the rapidity of its progress and likewise the attendant symptoms vary considerably. In this disease the bone cells and the spaces of the cancellous tissue are widened and filled with a juice; the bone is discoloured and of soddened aspect, or of reddish hue from the presence of unhealthy granulations, which give it a fleshy aspect. It is friable and yields to the edge of the knife or the pressure of the finger. The progress of this form of ulcerative destruction of bone consists in the enlargement of the bone-cells, which are filled with granular matter, the matter becoming indistinct; in the breaking up and fusion of the bone structure, by absorption of this effused juice, along the line of the medullary spaces; in the removal of the earthy matter in its granular form by this fluid; so that a dried specimen is light, irregular in shape, and readily broken, and we frequently find pieces which have quite lost their vitality and are more or less detached from living parts. The surrounding tissues partake of these morbid changes. In the section of a vertebra thus affected we readily trace the indications of pre-existing inflammation, namely, textural disintegration, ulceration, abscess, necrosis. The abscesses are either imbedded in the substance of the bone, or are formed nearer the surface. They vary both in form and size: some contain pus; others pus and blood; others contain pus surrounding a necrotic piece of bony detritus. In cases of recovery the matter becomes thick and inspissated by absorption of its watery constituents, when it acquires a yellow colour and thicker consistence, and has often been mistaken for tubercle.

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* Lawrence, 'Med. Chir. Trans.,' vol. xiii., 1827, p. 399.

† Nichet, C. c. p. 534, Obser. 9.

‡ Ollivier (d'Angers), 'Traité des Maladies de la Moëlle épinière,' t. i. p. 400.

In cases of progressive disease, the crumbling of the bone proceeds until great loss of substance ensues; the vertebral column yields and the spines project, as is so commonly seen in cases of "angular curvature." In these cases two, four, six, or even more vertebræ may be involved, the patient still retaining the power of locomotion, and in many cases finally recovering with a deformed back. It is in such cases that large abscesses are so apt to form, either pursuing the course of the psoas muscle and presenting in the thigh, constituting a "psoas abscess," or forming behind the tendinous origin of the transversalis muscle and presenting in the loins, constituting a lumbar abscess.

Should such abscesses be opened? Let not the surgeon act hastily. That pus may become inspissated by absorption of its watery elements is acknowledged by the latest pathologists; that it may be and often is removed by the absorbents is my firm belief. The gradual disappearance of a large collection of pus is an event by no means rare in surgery.

Should the collection enlarge, and by its presence give pain and disturb the patient's rest, its evacuation becomes a measure of relief; and as to the mode of opening such an abscess I find, after an experience of all known modes of operating, that the best instrument is a broad double-edged knife; that the opening should be free; that there should be no introduction of the probe nor pressure of the hand; but that the pus, after the first escape, should be allowed to flow slowly into a large soft poultice, made of equal parts of linseed meal and bread.

When the destructive process is rapid, the patient suffers all the signs of irritation of the spinal chord: there is constant pain in the back, aggravated by pressure or by exercise; the feet are cold and numb, or subject to a pricking sensation, as of pins and needles; the lower extremities are weak, and the patient is apt to stumble and fall. But in other cases where the disease is more chronic many of these symptoms are absent, the spinal chord adapting itself to its altered positions.

Respecting the number of vertebræ which may become affected in the same subject, Wedding relates a case in which it amounted to fifteen, namely, the four lower cervical and five upper dorsal, and the three lower dorsal and the three upper lumbar. Nichet mentions a case of destruction of the bodies of eight vertebræ in a child aged eleven, namely, all the vertebræ between the 2nd and 11th dorsal. The spinal projection was, of course, considerable; but the diseased parts had been repaired by the formation of new bone.*

The abscesses which form about these diseased bones may not present externally, but make their way into the bronchi or into the colon. Of these accidents numerous records are to be found in the writings of authors on pathology.

The train of symptoms, thus described, commencing in inflammation and yielding the usual inflammatory phenomena, have been supposed by many surgeons in all cases to arise from a fall or a blow, or other local injury. That such may be the case in some instances I would not deny; but it is contrary, I think, to evidence to admit the fact as a rule. Most parents are disinclined to recognise an hereditary tendency to local diseases; the words "scrofula" and "tubercle" are unpleasant sounds to a mother's ear as applicable to the illnesses of her own children. A fall or other accident is an event so common in infantile life, that no effort of the imagination is required to make one such accident fit in with the first symptom of spinal disease. But pathology teaches us that tubercle is often deposited in these cases, and that perhaps more frequently than is supposed.

A specimen (Ser. IV., No. 14, Museum St. Bartholomew's Hospital) shows a section of a spine with angular curvature. The disease is situated in the middle of the dorsal region, and large portions of the bodies of two vertebræ are destroyed by ulceration. A soft caseous matter is deposited around the diseased bone, and is so abundant in front and at the side of the spine that it elevates the periosteum of the vertebræ and the pleura costalis in the form of a tumour within the chest. A small piece of bone is separated from the rest by ulceration, and is imbedded in the caseous matter behind the ulcerated vertebræ. The medulla spinalis, for the space of an inch and a half, is compressed in the situation of the curvature.

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* Nichet, 'Gazette Medic. de Paris,' 2 Ser., t. iii. p. 534. Observ. 100.

Now the person from whom this specimen was taken was a patient of the celebrated surgeon, Mr. Percival Pott. There were the usual signs of "Pott's disease," paraplegia, &c. It was one of the first cases which showed the benefit of issues in the treatment of the disease, for under their influence the paraplegia and other symptoms were completely removed, and the patient recovered so as to walk with ease. He ultimately died with phthisis.

The effects of a fall may, however, at any time be followed, in persons thus predisposed, by serious consequences. A lad, seventeen years of age, became the subject of paraplegia, after the disease had existed two years. Issues were made near the diseased part of the spine, and he recovered sufficiently to pursue his work as a farmer's boy. But by a fall on his back acute inflammation of the spinal chord was excited, which appeared to extend to the brain, and thus he died. After death it was found that disease, which was in progress toward cure, had existed in the bodies of the three lower dorsal vertebræ. A large portion of the anterior and lower half of the body of one vertebra had been removed by ulceration; also the intervertebral ligaments above and below; the adjacent vertebræ were approximated and partially united by bone, but there was considerable angular curvature of the spine. The remains of the body of the vertebra which was principally diseased, and the bodies of the vertebræ above and below it, were denser and harder than natural, and of yellow colour. In some cases caries commences within the vertebral canal.

The position is sound and well established that bones, the subject of scrofulous or tuberculous disease, do not unite or heal by osseous deposit. Thus, so long as caries goes on, we cannot expect that firm consolidation of parts which is essential to a useful spine. But caries is not a lasting disease; when it has run its course the patient's health may be so far restored as to admit of processes of repair, which were once unattainable. In one specimen (Ser. IV., Sub-series D., No. 11) the bodies of six of the lumbar and dorsal vertebræ have been destroyed. The vertebræ above and below have been approximated and united firmly by bone. There is an acute angular curvature of the spine, but the diameter of the canal which contained the medulla spinalis was not altered in size.

In the same Series (No. 10) we have the sections of two lumbar vertebræ, in the body of one of which is an irregular circumscribed cavity, formerly the seat of an abscess, or possibly of necrosis. The cavity opens anteriorly through the body of the vertebra, and posteriorly by a wide aperture into the spinal canal. In the neighbourhood of the cavity the adjacent surfaces of the vertebræ are thickened and in part united by new hard bone. New bone is also abundantly formed on the anterior surfaces of their bodies. It is the knowledge of these facts that induces surgeons to urge upon patients the importance of rest in the recumbent position, with the hope that, the weight of the body being removed, the spine will be less disposed to curve backwards, and the deformity, on recovery, will be proportionately less.

The treatment of ulcerative and carious disease of the spine is a matter which in all stages demands our anxious consideration. On the one hand, the responsibility attending our directions that a patient should be kept in the prone position for one or two years, is most grave; on the other hand, the error of enforcing locomotion when the bones are friable and unfit to support the weight of the head and shoulders, is irremediable. We have often to encounter the natural anxiety and mistrust of parents and friends; morbid emotions and hysterical complaints from the patients themselves; and it is not always that any one course of treatment can be steadily carried out by any amount of persuasion.

I have seen several cases in children in whom the disease has been so chronic, so limited in extent, and so free from distressing symptoms, that it has run its course without special treatment, leaving as its trace a slight projection of one or of two spinous processes. But such cases are rare.

When, as is more commonly the case, the disease is progressive and threatening the changes above described, the surgeon must make up his mind as to the course to be pursued, and give his directions clearly, firmly, and with determination. A carious spine is unfit to support the superincumbent weight; it is not suited to the movement necessary in progression; no apparatus, however skilfully made, is fitted for a case of active disease, and yet the patient's recovery depends on the function of nutrition being well carried on—a process to which exercise is most necessary.

It is said that the presence of persistent pain in one part of the spine indicates, along with other symptoms, the existence of disease, and that the tender spot can be ascertained by manual examination or by the application of a heated sponge. Such an amount of evidence would, in my opinion, be sufficient to justify caution and the imposition of repose until such tenderness had subsided, but would scarcely be of weight enough to warrant a more serious view of the case. The meaning of the word "pain" is very differently accepted by patients: there are some who shrink from the slightest touch, while others again conceal the very pain which they endure. With females the uncertainty of trusting to the description of their own sensations is proverbial, and hence the term "hysterical pain" and "hysteria" has been very freely admitted into the modern system of medicine, not always to the advantage of the patient.

The clearest proof of carious disease of the spine is derived from the projection of the spinous process, the weakness and cramps in the limbs, and the pain experienced by pressure on the spine. The surgeon should not wait for disturbances connected with the functions of the bladder or rectum. The patient should be directed to assume the recumbent posture, and to remain so, with attendants to give all assistance in the discharge of the bodily functions, until the diseased condition of the bone has passed away. The administration of nutritious food, amusement to the mind, passive exercise in a carriage by the sea-side, tonic remedies, and constant nursing, are the measures indicated.

To how many persons, especially among the poorer classes, is the recommendation of such a course of treatment applicable? Even among the wealthier members of society it involves an amount of care and expense, and abstraction from other duties almost unendurable. I have had on many occasions to wonder at the devotion of character often shown by those in attendance on a child suffering from this wearing disease. But such perseverance has often been rewarded by the restoration of the patient's health and the firm consolidation of the ulcerated bones with comparatively little deformity. The confinement is borne, after a time, easily by the patient, who amuses himself with books and other sources of enjoyment; the health suffers less than would be expected. One of the best remedies is cod-liver oil, given in doses as large as can be taken without producing nausea, or cod-liver oil and the syrup of the iodide of iron. It is not always that the patient has an appetite for meat, in which case he may take farinaceous food, eggs, &c. A moderate quantity of wine or beer is quite allowable.

Counter-irritants in the shape of issues, moxas, &c., are not often used, unless to correct symptoms of spinal irritation, such as cramps of the limbs, &c. It is, however, impossible wholly to ignore the strong recommendation given by Mr. Pott in favour of the good effect of issues, however much our ideas of treatment have undergone change from the feelings of the past.

The patient's own sensations are generally a good indication of the amount of repair effected in the weakened bones. Instead of lying quiet and helpless, he moves his limbs and becomes restless under restraint; and in this stage an apparatus to support the spine may soon be worn with advantage. It consists of a well-made pelvic band of padded steel, of two lateral steel supports extending to the axillæ, and of a webbing-band, or small movable pad, to press lightly on the angular projection. This apparatus, worn under the dress, gives the patient no inconvenience, but, on the contrary, prevents his feeling that fatigue which renders him at first indisposed to and fearful of taking exercise.

There are specimens in the Museum to show that the intervertebral ligaments may be removed independent of or preceding the disease of the bones. Thus (Ser. IV., No. 20) a section of a spine exhibits disease in the dorsal and lumbar vertebræ. The disease consists in an alteration of colour in the bone, apparently from morbid secretion into the cancellous texture. Between two of the lower dorsal vertebræ the intervertebral substance is completely destroyed, and the adjacent surfaces of the bodies of those vertebræ are slightly ulcerated. In the month of February, 1846, I examined the body of a young man, the son of a distinguished artist. He was twenty-one years of age, and had suffered three years previously from scrofulous disease of the testis. Subsequently a scrofulous abscess formed under the clavicle. Then disease of the spine supervened, with angular curvature and tuberculosis of the lungs, from the effects of which he died. On examination of the body, both lungs were found consolidated, especially at the posterior part, by tuberculous deposit. The right lung was the most permeous to air. At the posterior part of the left lung there was a large tuberculous cavity, containing pus and scrofulous matter, the posterior wall of which was formed by the convex surfaces of the bodies of the dorsal vertebræ, the anterior and lateral parts of which were denuded of covering and superficially ulcerated. The intervertebral cartilages were nearly entirely removed. There was a large cretaceous mass in the mesentery. In both testicles the epididymis was thickened, and the tube of the vas deferens contained yellow tuberculous matter.

Lateral Curvature.—In the reign of Louis XIV. of France, a child of eight years, belonging to the royal family, began to suffer from lateral curvature of the spine. There was made for her, says Dionis, little corsets of whalebone, and an easy chair where there were cords, which, passing under the axilla, took off the weight of the body and gave relief from the pressure of the superincumbent parts. But it was not possible to avoid great deformity of figure. This person of quality was, in short, humped-back. That was all, says Bouvier, that could be done for a Princess of the Blood in that great age. We can do better in this day for a daughter of the people.

I mention this fact that those who object to the treatment of lateral curvature of the spine by mechanical appliances may see that the deformity has existed and has been recognised in times gone by, and that its progressive character, when unchecked by supports, has been duly recognised. Until some better plan of treatment can be devised, we must be content to avail ourselves of such means as are in our power.

Surgical opinions, however, vary greatly on the subject; indeed, I have heard the employment of all heavy apparatus condemned in bitter terms. But slightly-made instruments are equally inconvenient to wear, and are of no avail in remedying the deformity, inasmuch as they bend and twist under the resistance offered by so powerful a chain of bones as the vertebral column. The surgeon who desires to benefit his patient should not only study the pathology of lateral curvature, but should render himself familiar with all the details of mechanical appliances. He should know where to gain the fixed point whence the movable pad may be moved to press on the spine, and he should learn how long-continued yet moderate pressure, well applied, will finally overcome the greatest resistance.

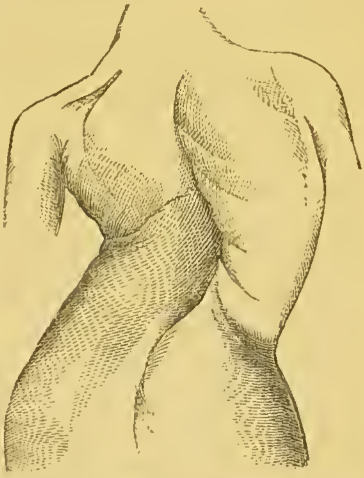

Fig. 9.—Double Lateral Curvature of the Spine.

It is remarkable, however, how much, until quite of late years, this subject has been ignored by the profession, and how completely it has fallen into the hands of specialists. Although, as Mr. Erichsen observes, "its pathology and management lie in a very narrow compass," there is yet something to learn before we can be said to have mastered the difficulties with which its progress and treatment are surrounded.

Lateral curvature of the spine may be single or double: that is to say, it may include the greater part of the spinal column in one sweep, the convexity being usually to the right; or it may be double (as represented in the woodcut), the convexity of the upper curve being usually, but not always, to the right; the convexity of the lower curve in the opposite direction. It is sometimes seen as a congenital deformity, in which case the convexity is usually directed to the left, and is high in the shoulder. In the congenital variety it is equally common in boys and girls.

As a non-congenital or acquired deformity, it is most commonly seen in growing girls, commencing about the age of thirteen. It is the upper curve which first forms, the lower one being a "compensating curve" to maintain the balance of the body. Although usually seen in girls, it is also seen in boys of a similar age. I have had, and have now, several such cases under treatment.

In all cases where the lumbar region is involved there is a very great amount of rotation of the vertebra; indeed, the transverse processes may be directed backwards, and so be mistaken for the spines. The vertebræ are often deformed (*vide* woodcut).

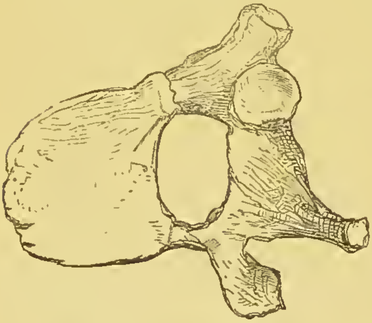
Fig. 10.—Deformed Vertebra.

The progress of this affection is attended with much pain. In its early stages it makes way insidiously, no deformity being visible when the dress is on; the patient complains only, when tired, of an aching of the right shoulder, or of darting pains under the breast. A careful examination, however, when the dress is removed, detects a "growing out" of the shoulder; and a still closer inspection brings to light the curvature of the spine, which may include more or less of the vertebral column. It is this condition which has given rise to the invention of that hypothetical accident, dislocation of the lower angle of the scapula over the border of the latissimus dorsi. The rate of progress of curvature varies extremely. In some instances a most serious and hopeless state of deformity is produced in six months; in others, the curvature increases slowly and continues during many years at an equally slow rate; or, on the other hand, may suddenly, and without apparent cause, advance with tenfold rapidity.

The symptoms to which it gives rise, inconsiderable at first, become gradually more intense, and finally deprive the patient of the means of enjoying life.

The alteration of shape in the bony fabric of the chest and vertebral column leads to serious displacements and functional disturbances of the viscera of the chest and abdomen. The heart beats irregularly or tumultuously, exciting in the patient's mind fears of cardiac disease; the aorta and its great branches become twisted, so that the cerebral circulation is interfered with, and frequent faintings ensue; the breath is short, and neuralgic pains shoot across or around the chest; the hands become cold or cramped; the stomach, pushed from its proper place, will not readily retain food; sickness, flatulence, ensue; the appetite becomes capricious; the liver is sometimes pressed to one side, and morbid adhesions form between it and the walls of the abdomen. But the greatest suffering is the patient's own mental condition. The consciousness at every change of attire of increasing deformity; the physical suffering, half understood, yet always present; the dread of what the future may bring, and, in many cases, the destruction of early hopes formed to pass through life; these circumstances prey on the mind of the young to an extent sufficient to produce complete mental prostration.

I attended a lady, aged thirty-four, the subject of lateral curvature, in whom sudden faintings so commonly and unexpectedly supervened that she feared to walk out alone. The deformity had commenced at the age of fourteen, and after a time became stationary; but, on being married, she had more active duties to attend to, and the curvature made rapid progress. She recovered completely under the employment of a proper apparatus.

In other cases the lower extremities have become powerless and the feet deformed. I remember a case in which a patient had been bedridden for seven years, and who recovered the power of locomotion so soon as the effect of the twisted vertebræ on the spinal chord was removed by proper support.

It is true that spinal curvature prevails among the upper ranks, but there is a vast amount among the working classes. I have frequently had under my care at one time two or three sisters of the same family, in each of whom the deformity was induced by too constant work at the needle. Among lads, those engaged in watchmaking and other sedentary pursuits seem most to suffer; but among the field labourers of the Continent, mostly women, spinal curvature is common, in consequence of their being engaged in pursuits too laborious for and unsuited to their sex. The causes of lateral curvature of the spine mostly point to the one condition of general debility: to an insufficiency in the textural hardness of the bones, dependent on imperfect nutrition. And in the treatment of this affection our object should be, while employing proper mechanical support, to supply this deficiency either by suitable diet or medicine, or by imposing habits of proper exercise, which have, in all probability, been neglected.

We regard, then, a state of general debility as the predisposing cause to lateral curvature of the spine.

The exciting causes are numerous. The repeated maintenance of one constrained position for many hours in the day, as in playing the harp, drawing, or writing, particularly if the patient be short-sighted and obliged to bend the head lower than usual in order to read print; standing on one leg; the forced position of many industrial pursuits, such as dressmaking, lace-manufacturing. In patients affected with rickets the condition of the bones is such that they yield readily in any direction.

The training of growing children is often inconsiderately carried out. School-girls should not rise at 6 A.M., and have two hours' lessons before breakfast: the mind is not in a state to profit by such exercises, and the bodily trial is frequently shown by faintings which no effort can control. The time allowed for meals and out-door exercise is insufficient, amounting to about two or three hours in the whole; while the two large items of nine hours each in the twenty-four are given up respectively to tuition and to sleep. The decorous walk along the high-road gives none of that invigorating freshness which the active games of boys induce, and hence in many instances an amount of listlessness supervenes; the waste of material being slight, the appetite becomes small and capricious, and nutrition is not well carried on. It is in such a state of body as this that curvature of the spine is apt to commence.

But even in boys' schools the system pursued is not always judicious. "I know an institution," observes Dr. E. Smith, "receiving, perhaps, 150 boys, of ages varying from ten to sixteen, and having all the staff of a college, in which the following is the daily routine. They rise at 6 and engage in studies until 8 A.M.

without receiving any food. At breakfast they have a mug of cold milk and half a round of bread placed before them; and, after a time, the bread-basket, containing quarter-slices, is passed round, from which the pupils may take a piece. After the morning studies, the dinner consists of meat, of which a quantity is given which the boys whom I know state is much less than they receive when at home, and to which bone is usually added. The quantity of potatoe is very small generally and bread is not given. Pudding is sometimes given, and sometimes bread-and-cheese supplies its place. Only one other meal is allowed in the day, and that is similar to the breakfast. Thus there are only three meals a day allowed, two of which are cold, and the meat is practically much limited in quantity. There are, moreover, more than two hours in the morning during which no food is supplied· and during part of which the brain must be at work; and there are fourteen hours between the meagre supper and the following breakfast. Such a diet must be an insufficient one in the total quantity of nutriment, and particularly in the fat which is supplied; and it cannot be a matter of surprise that the boys which I saw were very spare and very tame and quiet both in body and mind." *

The evil effects of improper and insufficient food are still further increased by limiting too much the period allowed for exercise, and extending too far the time devoted to brain-work in the heated air of a crowded study.

For an adult, not taking any violent exercise, the

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* 'The Present State of the Dietary Question,' p. 11. 1864.

following diet-scale may be considered sufficient, but not too much, for daily consumption.

For an adult *male*—tea, Oii.; bread, ℥xiv.; meat, dressed, lbss.; potatoes, lbss.; beer, Oii., or Oi. porter; butter, ℥i.
„ „ *female*—tea, Oii.; bread, ℥xiv.; meat, lbss.; potatoes, lbss.; beer, Oi.; or porter, Oi.; butter, ℥i.

Such a scale of diet is often improved by extras; nor is there any great difference for growing lads or girls, in whom an equal, if not greater, demand for sustenance exists. Do we find among those of the upper classes subject to spinal deformities the power of assimilating food to this amount? Many females often foster a morbid aversion to proper food, and indulge themselves in wayward appetites. The law, however, is imperative that there must be a proper relation between the supply and the demand, or textural degeneration will inevitably ensue.

The treatment of spinal curvature, to be successful, must be undertaken with all the advantages of mechanical appliance from the very outset of the disease. The patient will not "grow out of it." Sooner or later the spine yields more and more, until an incurable amount of deformity is produced. I have had one case in which the first symptom commenced at the age of fifteen, but the deformity remained in abeyance until the age of twenty-six, when sudden increase in the curve ensued. In another case the patient was over sixty years; she had tolerated the deformity in its moderate form for the greater part of her life; but towards its close the curve rapidly increased, and the left shoulder sank so much that there was fear of its reaching the crest of the ilium. Similar cases are numerous in the practice of any orthopœdic surgeon.

Relief can be afforded in no other way than by the pressure exerted by proper, firm and strong apparatus. On this point there can be no compromise; all other known measures have hitherto proved unavailing. In the examination of the spine, with reference to instrumental support and diagnosis, the following points should be remembered. A large proportion of patients, the subjects of spinal curvature, are of fair complexion; many are anæmic. On inquiry, the surgeon soon finds out that the habits have not been such as to develope bodily strength. The spine should next be examined in its whole length. The most favourable cases are those in which the projection of the right shoulder-blade is slight and there is one simple curve, the convexity to the right occupying the greater part of the vertebral column. This condition can be put right by the use of a proper spinal apparatus, and in most cases the cure is permanent. The more unmanageable cases are those in which the curvature is double: the upper curve with the convexity to the right, the lower with the convexity to the left, accompanied with vertebral rotation and an alteration in the shape of the bones. In these cases we may arrest or retard the further progress of the deformity, but we cannot hold out a prospect of perfect cure.

That such a condition may speedily become incurable is ascertained by the examination of a spinal column so prepared that the state of the vertebræ can be ascertained. Ser. IV., Sub-ser. D, No. 16, exhibits the spine, thorax, and pelvis, from an adult woman. All the dorsal and the two first lumbar vertebræ are comprised in a lateral curve, the convexity of which is directed to the right and backwards. There are slight compensating curves in the cervical and lower lumbar regions of the spine. The bodies of the vertebræ and the intervertebral spaces are much deeper in the convexity than in the concavity of the curve; they are also twisted round, so that which was their anterior surface is directed outwards towards the convexity of the curve; this outward direction being chiefly observed in those vertebræ which are in the middle of the curve, while those at each end of it gradually approach nearer to their natural direction. Connected with this twisting of the bodies of the vertebræ is a narrowing of the space between the spinous processes and the right transverse processes of the vertebræ, although the spinous processes are directed rather towards the left side, that is, towards the concavity of the curve. The space between the spinous and left transverse processes is somewhat increased in width and depth. The thorax projects obliquely forwards and to the left, and its sides are flattened. The posterior portions of the right ribs are directed downwards, lying nearly in contact with the vertebræ, and then bending abruptly round the vertebræ. The ribs are directed forwards and to the left, with narrow intercostal spaces.

The left ribs crowded together in the concavity of the curve are directed almost horizontally, first outwards, and then straight forwards; only their extreme ends and their cartilages being directed inwards to the sternum. The sternum and anterior walls of the thorax are arched as much as the lateral walls are in their natural state; while the lateral walls are as flat as the anterior should be.

The cavity of the pelvis is of ordinary size, but its antero-posterior axis, in correspondence with the obliquity of the lumbar vertebræ, is directed obliquely from before backwards, and from right to left.

We assume, then, from experience, that when the curvature is recent, single, and when it readily disappears on pressure, the case is one which admits of complete relief. When, on the other hand, it is double, we conclude that some of the changes here described have supervened in the osseous fabric, and that we can do no more than arrest further mischief and so relieve symptoms.

In slight cases, and especially in the young, an adequate amount of mechanical support can be afforded by side steel crutches, introduced into well-made French stays. These stays, which should be fitted on by an experienced maker, must be, in ordinary parlance, much too small, in order that the patient may have the power of producing a certain amount of pressure by tightening the laces. The stays having been properly fitted, the surgeon, or the surgeon's instrument maker, marks with a pencil the lines which indicate the place where the steels are to be inserted; these must extend from the axilla, where there is a slight padded rest, to the lower border of the stay over the hip. The shape which the steel crutches must assume, and the degree of outward curve from the waist over the hips, is ascertained by means of a long strip of lead, which admits of being bent to any form.

This apparatus has the merit of being light and easily worn. It requires no alteration in the wearing apparel, and often even improves the figure. When once fitted on, the eye can often detect a difference in the two sides of the body, previously not noticed. Broad steel pads may further be introduced, if required, to press on any one point. In this way I treat most cases in the first stage of the deformity. The apparatus is worn with such ease that patients can pursue their usual habits, and walk, run, or ride without fear of rubbing or excoriation of the skin.

In the next stage, or that in which we detect a positive curve in the vertebræ, the apparatus here depicted, or one framed on a similar principle, becomes necessary. It is after the fashion of Tavernier's belt, the difference being that in the former, the support afforded to the spine acts by the pressure of a pad worked with a cog-wheel, instead of by the more general pressure of a webbing band. This apparatus can be worked with greater accuracy, and is capable of

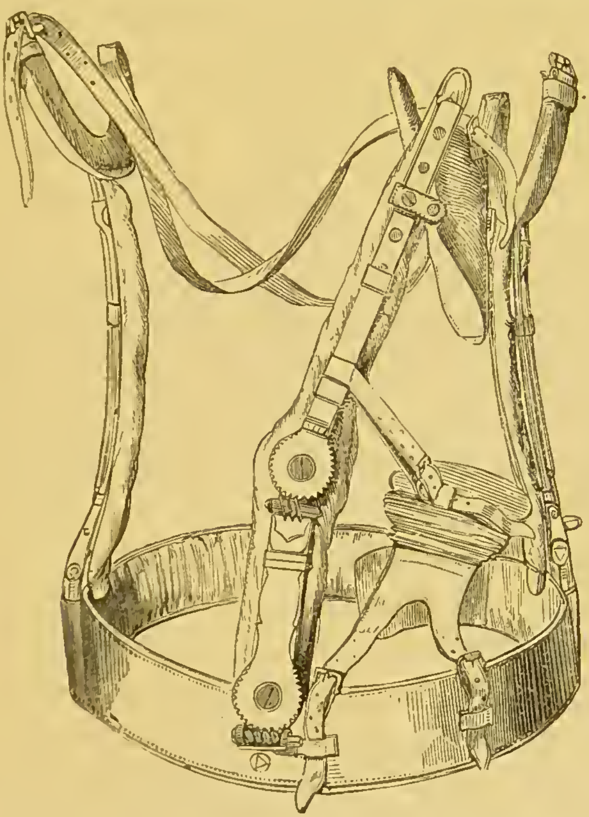

Fig. 11.—Apparatus for the Treatment of Lateral Curvature of the Spine (Tamplin's).

effecting as much benefit as can be obtained in these unfortunate cases. There are many modifications of such machines, but all combine in having a firm pelvic band and side steel crutches; also a movable pad, which presses on the displaced vertebræ through the ribs. My friend, Mr. W. Adams, has endeavoured to contrive a sort of rotatory movement to act on the twisted spine or vertebræ.

Upon the subject of these instruments and their use, I shall be brief. Many view them with disfavour, and perhaps not wholly without cause, for they have been employed where gentler measures would have answered, and great success has been proclaimed where but little has been obtained.

Still I would urge upon my professional brethren to consider more closely the condition of the patient, and to put the question, What better means do we possess of affording relief?

Spinal curvature is progressive. The patient, enduring constant pain and discomfort, sees the figure becoming worse from week to week. She cannot walk, she breathes with pain, and every function is disturbed. In this state she *insists* on something being done to give her ease, and experience has shown that some amount may be obtained by mechanical treatment. It is asserted that these instruments are too heavy; but a light apparatus is useless. The spine, even in a young subject, is of great strength, and none but a powerful and unbending instrument will act upon it. I have had light instruments made, but have found after a few weeks' work the steels were bent and the screws were out of order.

But a proof of their utility is derived from the fact, that infants in arms bear them readily. I have alluded to the congenital form of spinal curvature. This distortion seems greatly to distress the child, which has often a worn, twisted look; it cries much, and will not take the breast.

It has been affirmed that congenital spinal curvature is due to intra-uterine pressure. This I doubt, for in the first place, we sometimes find it associated with deformities of the feet, such as talipes varus; or with incomplete closure of the vertebræ, spina bifida. Moreover, if one has the opportunity of dissecting such a spine it will be seen that no power will make it straight. In one case I cleared away the muscles down to the bone, and yet found the curvature unchangeable. It was clearly due to the shape of the vertebræ, and their connection with the ligaments, and must have "grown" so during the period of development in fœtal life.

People complain that the treatment is prolonged and tedious. I know no way of avoiding this inconvenience. No sudden force can be effectually employed, and patients cannot manage their own cases.

After one, two, or three years the spine recovers something of its normal form, and the distressing symptoms of which the patient complained disappear. Each year of increasing strength offers some guarantee against a return of the deformity, and the viscera act again normally.

When the surgeon is fully convinced that no further benefit can be obtained by the employment of the instrument, he directs the use of the stays mentioned at p. 178.

In cases where the curvature makes sudden and rapid progress in persons of advanced age, the most that we can effect is to keep the body well braced up by the easiest apparatus that can be constructed. In this way aged persons are enabled to continue in the enjoyment of accustomed habits, such as fancy gardening, &c., and to sit up of an evening in the society of friends.

Before quitting this subject I would enumerate the names, almost obsolete, which are applied to different forms of spinal curvature :—

Lateral curvature—Skoliosis.
Posterior curvature—Cyphosis.
Anterior curvature—Lordosis.

The last variety is in most cases connected with anchylosis of the hip-joint, or with congenital dislocation of that articulation.

It is said, however, that this distinction is of comparatively modern invention, and that many of the older writers, such as Delechamps and Ambrose Paré, used them as common.

As already mentioned, a single curve can be generally cured.

Case I. Rosa S., aged nineteen, a fine healthy-looking girl, but tall, from the country, was the subject of lateral curvature of the spine. The curvature was single and to the right, but easily disappeared on pressure. She had been under the care of a surgeon, who had recommended a pelvic band and double crutch; but she became every month more deformed, until further advice was obtained. I saw her November 17, 1857, and directed that a pad worked with a cog-wheel should be applied to the apparatus so as to act on the curve. On May 1, 1858, I heard that the girl was in much better health, the pressure had been steadily maintained, and all pain had subsided. June 8, I saw her again.

She was in perfect health: the spine was perfectly straight. After the six months she was enabled to lay aside the apparatus and to wear stays properly supplied with side steels. This is one of the simplest cases. My colleague, Mr. Carr Jackson, has favoured me with the particulars of another case equally successful, which he had lately seen previous to the patient's marriage.

Case II. On May 4, 1858, I saw a woman, aged fifty-eight. The curvature was confined to the dorsal regions and the convexity as usual directed to the right. There was paralysis of both upper extremities, nearly complete, with withering of the muscular tissue. A special apparatus was applied, but I lost sight of the patient.

Case III. Miss H., aged twenty-one, was the subject of rickets in infancy; the legs are very short and curved, and the left lower extremity is two inches shorter than the other. Her height is about four feet, she has a double curvature of the spine, and complains of weakness of the back, palpitation of the heart and inability to do any sort of work. March 2, 1858, an apparatus with a double pad was applied, and a boot with a compensating sole to the left foot. Nov. 4.—Her condition is much improved. She has no pain and can take exercise with comfort.

Case IV. Miss W., aged fifteen, came under my care May 14, 1858, suffering from the effects of a single lateral curvature of the spine. The immediate effects were an aching pain under the right shoulder, a general sense of weakness, and disordered menstruation. The usual apparatus was applied. August 1.—The pains have subsided. November 7.—The catamenia, which had before been suspended, had now returned with their proper regularity.

Case V. John S., aged twenty-four, October 30, 1859, the subject of single lateral curvature, the convexity to the right. The symptoms were pain in the shoulder and weakness of the back; pain in the groin; headache; epistaxis; unable to work at any sitting occupation on account of fits of giddiness; ordered the usual apparatus. March 4, 1860.—The pains had subsided, general health much improved.

CHAPTER IX.

MORBID CHANGES IN MUSCLES AND TENDONS.

Congenital defects in muscles are seen in cases of club-hand, of club-foot, &c. In some the muscles are too long: more often they are too short, the muscular fibres being deficient, so that the tendon is unduly exposed, and the limb is smaller than natural in circumference. The muscular structure is often pale and fatty, or fibrous; in other cases there is complete deficiency as in some of the severer cases of club-foot in which the extensors of the toes are absent.

Hypertrophy of muscle does not commonly co-exist with joint-disease. I have, however, seen such cases in the deformity known as talipes equinus. The muscles of the calf have become enormously developed, and, overcoming the action of the extensors, have prevented the elevation of the foot. A patient, the subject of this condition, first walks on his toes; then the heel becomes raised, so that it cannot touch the ground; if not corrected, the deformity may increase so as to turn the dorsum of the foot on the ground. The division of the tendon is followed by some amount of atrophy of the muscle and the replacement of the bones to their normal relation. Hypertrophy of muscle, as a disease producing functional disturbance, occurs far more frequently in the heart, the muscular coat of the intestines, bladder, &c., as a consequence of long-continued irritation; and Bardeleben has related cases, where, in consequence of long-continued difficulty of respiration, hypertrophy of the intercostal muscles has been observed.* Rokitansky believes in positive increase in the numbers of muscular fibres (numerical hypertrophy), also in their general enlargement. The increase in quantity of the connective tissue adds materially to the bulk of the part.

Atrophy of voluntary muscle is witnessed as a consequence of long-continued and exhausting illness, or as a natural change of old age. Local atrophy proceeds (*a*) from injury, as in withering of the deltoid muscle from a fall on the shoulder; (*b*) from the development of tumours interfering with movement; (*c*) from paralysis; (*d*) from cold, &c.

In cases of fatty degeneration of the voluntary muscular structure, we find that they readily tear away from their bony attachments. Cases are not uncommonly seen, in which the extensor muscles of the leg become detached from the patella, in consequence of some sudden movement of the body.

Inflammation of the muscular tissue is uncommon. That condition which bears most resemblance to it, is the painful condition of the arm and subsequent withering of a set of muscles in persons who follow some one peculiar avocation. Of such is the "writer's cramp." The extensors of the thumb, exhausted and atrophied, leave the flexors too great an amount of uncontrolled power, and the thumb, after holding the pen for a few moments, slips from its hold into the palm. I know of no treatment, save that of rest, by which this condition can be improved; patients have to choose between learning to write with the left hand, or of having a penholder fixed to two rings which are adjusted to fit the fore and middle finger.

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* 'Virchows Archiv.,' B. i., 1848.

I have met with one case of venous nœvus in a muscle, it was situated in the deltoid muscle of a young lady, from whom it was removed by operation many years ago.

Suppuration or ossification of muscle to any great extent are very rare. Specimen 30, Ser. V., Museum of St. Bartholomew's Hospital, exhibits two psoas muscles. Externally they present an ordinary appearance, but on cutting into them, their interior was found to be filled with dried-up pus, which occupied large cavities shown in the preparations. These, which, with their contents, usurped the place of the greater part of the muscles, were lined by an irregular glistening membrane of an imperfect fibrous structure not unlike that which often walls in a chronic abscess. The preparation was taken from the body of a middle-aged man brought in for dissection.

No. 2 (Ser. V.) is part of a vastus internus muscle with the superficial and the deep femoral arteries. Large portions of the muscle are ossified. The largest portion of bone lies so close to the arteries, that it probably presented during life the character of a pulsating tumour.

Occasionally malignant tumours are developed in the muscular tissue; and the Cysticercus cellulosæ find their nidus in the connecting cellular tissue.

Tendons, as mentioned elsewhere, undergo distinctive change consequent on rheumatic inflammation.

No. 32 (Ser. V.) exhibits a fibrous tumour involving, and blended with, the tendons of the flexor carpi radialis, palmaris longus, and flexor sublimis muscles. It had existed, slowly enlarging, for five years, but had never occasioned the slightest inconvenience. It was removed, after death, from the right forearm of a man who died from acute pneumonia.

I saw a large fibrous tumour imbedded in the tendo Achillis of a young gentleman under the care of Mr. Tamplin. It had been slow of growth and unattended by pain. The whole was removed by a single longitudinal incision over the tendon, and two transverse incisions through the tendon above and below the tumour. The wound was carefully united; the foot kept extended for a week until the ends of the divided tendon had become united. Extension was then very slowly carried out by means of a Scarpa's shoe, until the proper length was attained. Recovery was perfect to this gentleman, who now walks, without any instrument, as well as if no operation had been performed.

Some sudden and violent movement may be followed by stretching of the ligaments, particularly in a person of no great amount of muscularity. A lady stepping from her house into a garden slipped with the right leg under her, and fell to the ground on that side. She was unable to rise without assistance or to walk, and was accordingly carried into the house and put into bed. On examination there was found by the surgeon in attendance a considerable swelling on the outer side of the knee, and no manipulation would remove it.

As the swelling was clearly due to displacement of bone, another opinion was asked, and the patient was seen by the late Mr. Stanley.

There was found dislocation of the head of the fibula outward to the extent of three-quarters of an inch; the movements of the knee-joint as regards flexion and extension were perfect: no particular treatment beyond that of rest and pressure was adopted. February 5, 1859.

It is from this want of muscular tone, combined with a loose and relaxed state of the ligaments, that unaccustomed luxations occasionally take place. In the winter of 1839, December 27, a young man, Thomas Vaughan, aged nineteen, was brought into St. Bartholomew's Hospital, suffering from complete dislocation of the tibia and fibula forwards. Being rather tipsy, he undertook to jump at one spring down a flight of stone steps about ten feet perpendicular height from the ground. He accomplished the act, alighting upon his feet with the knees very much bent, when he instantly fell to the ground. He said that he felt "something slip back and press like a tumour in the right ham." The pain was so great as to oblige him to turn on his face and press the knee against the ground to relieve the distended integuments. In this position he was brought to the hospital, the leg nearly straight, but separated from its fellow. The shortening was full three inches, and before the clothes were removed, there was some resemblance to a dislocation of the hip. The knee once exposed, the form of the condyle of the femur could be readily seen and felt projecting backwards behind the tightened integuments: the tibia and fibula were thrown so much forward in the front of the femur that the finger could be put on the articular surface of the tibia: the patella was very movable; the foot directed downwards (*i.e.* extended). Reduction was easily effected. No unfavourable symptoms supervened, and at the end of a month the patient went home with a stiff leather case around the knee.

CHAPTER X.

HYSTERICAL AFFECTIONS OF JOINTS—WRY-NECK—SPRAINS.

The occurrence of pains in joints, attended by contraction of the limbs in young women supposed to be suffering from disturbance of the erotic passion, has been long a favourite theme with many authors. Some practitioners even have professed to recognise the existence of a similar affection in patients of the opposite sex. I am inclined to think that in these respects the doctrine of hysteria has been over done, and has often led both the surgeon and the patient's friends into error.

That many persons are subject to delusions, even as to pain, is indisputable; but such cases are generally easily recognised by close and impartial observation. For instance, a young woman, during a period of mental excitement, fancied herself pregnant. Although placed under the strictest surveillance, she was observed to become larger in the abdomen, until, finally, a medical examination became necessary, and it was then discovered that she had, at the cost of proportionate suffering, retained the urine so as to cause enormous distension of the bladder. This was relieved by the use of the catheter. Other patients have fancied themselves passing into a state of rapid emaciation; others that they were unable to walk from some displacement and painful condition of the uterus, &c. While, on the one hand, the experienced surgeon will not fail sooner or later to detect those who are the subjects of mere hallucination, he will, on the other, be ready to confess that the more accurate pathology of the present day has taught the existence of disease where none heretofore was suspected. He will, in short, come to the conclusion that the word "hysteria" has often been used to cover a hasty examination and shallow experience.

It has been said that contraction of the limb is very common in girls, the subjects of hysterical affections of joints; that in the case of the knee the leg will be bent at a right angle. Upon what principle do we explain this statement? I must confess myself unable to answer the question, unless it be that there is disturbance of the functions of the organ presiding over combined muscular action; that the equilibrium is upset, and the flexors being the stronger, pull the limb accordingly in that direction.

But if hysterical affections of joints are common in practice, I have been unfortunate in having had but a limited experience. Some cases of "hysteria" of the knee have turned out, where we have had opportunities for examination, to have been disease of the cancellous tissue of the bone, with deep-seated and partial detachment of the articular cartilage. This spot, though small in extent, and easily overlooked, even in *post mortem* examination, may be the seat of the most acute pain on pressure; and the flexure of the limb is an almost involuntary act on the part of the patient to obtain ease. Cases of "hysteria" of the hip have proved instances of chronic rheumatic inflammation, with the usual changes of cartilage and bone. The patient has limped about with the thigh bent until some surgeon, more adventurous than the rest, has given directions that the limb should be forcibly put straight under the employment of chloroform, and kept so by a wooden splint. The result has been that, after severe aggravation of all the symptoms, the limb, in course of time, has been found shortened two or three inches in consequence of destruction of the head and neck of the femur by ulceration.

In 1850, a gentleman, returning to England after a residence in a warm climate, was exposed for many days to an unusual amount of cold and moisture in the British Channel. On coming ashore he became conscious of severe pain in the right hip, which induced him to take the advice of several surgeons. The prevailing opinion was that his complaint was neuralgia, and he was advised to take as much exercise as possible, and to employ a stimulating liniment. Being a person of great determination, he walked about, although exercise aggravated his sufferings. When I saw him, at the expiration of eight months from the commencement of the attack, the limb was shortened to an extent of two to three inches and everted.

A proposal has been made, by way of diagnosis, to examine these cases, under circumstances of doubt, when the patient has been rendered insensible by the administration of chloroform. It is affirmed that if the movements of the joint are free in every direction, and that there is no grating nor other abnormal sound, the case must be one of hysteria: on the other hand, if the joint remains stiff, and the bones grate, it is one of "disease." I ask, could any test be more coarse and fallacious? The interior of a joint may be to all appearance perfectly normal, the cartilage bright, the synovia abundant, and the ligaments firm, but yet there may be deep-seated detachment of the cartilage from disease, limited in extent, but the seat of intense pain. This is the early indication of the severest form of articular disease, one which proper medical treatment and the imposition of rest in an easy position might bring to an end, but which any other treatment would hurry into general and incontrollable activity. So many cases have I seen in which mistakes have been made respecting "hysteria" of joints, that every year adds to my mistrust of such diagnosis.

I do not deny that such a perverted state of the mind may exist, nor that the love of sympathy and the desire to excite compassion may lead persons to an exaggeration of very bearable ailments. All I would urge is caution in diagnosis and never-ending investigation.

Among cases of supposed hysteria I may mention the particulars of one, which baffled the treatment of a large number of eminent practitioners. A lady was for many years after marriage the subject of severe headaches, followed by violent attacks of sickness. They did not seem to affect the general health, though almost unendurable while they lasted. Next this patient suffered from general debility, feebleness of the lower extremities, perverted appetite, shortness of breath. She then became extremely nervous and apprehensive about her health, and finally lost flesh and died at the advanced age of seventy-six, under symptoms of anomalous character. The various ailments had all been referred to "hysteria." She had taken every possible medicine—valerian, steel, quinine, purgatives, &c. Examination after death showed that she had during the greater part of her life been suffering from progressive lateral curvature of the spine, and that the immediate symptoms preceding death were due to endometritis, and contamination of the blood by purulent absorption from an effusion which occupied the interior of the uterus. Had this patient's spine been properly supported by mechanical appliances in early life, she would have been spared very many of her early ailments. Had the progress of the curvature been stopped by similar means after marriage, a corresponding amount of relief would have been attained. By a proper knowledge of the case the morbid changes which immediately preceded death might have been averted.

I have seen several cases of spasmodic closure of the hand in young females. The fingers are drawn closely into the palm. They may be slowly extended, but when set free they return in a few minutes to this contracted condition. In such a case the hand is quite useless, and a working girl can no longer follow her avocation. This is purely a spasmodic affection, but yet not under the control of the will. I witnessed the first case in a girl, aged seventeen, many years ago, in whom I failed to give relief by neglecting the very simple expedient of keeping the fingers extended on a proper splint. The patient was not "shamming," for I well remember her angry look when she called to show me the hand again in a useful state after some weeks of mechanical extension and general treatment. I lately had a similar case under my care in the person of a young lady, in whom a cure was effected by steady mechanical extension, combined with the use of the galvanic chain, and measures suited to promote her general health. On calling, after three months' treatment, to show me the hand, which happened to be the right, she took up a pen and wrote some words with complete steadiness and precision. This patient, however, had had during treatment a sharp attack of fever, which confined her to bed for some weeks, and in that period the condition of the hand improved in a marked degree. The contraction of the flexor muscles may be so great that the tendons stand out at the wrist in strong relief. It may be necessary to divide them subcutaneously, care being taken to avoid the division of the median nerve, which lies between the superficial and the deep flexors, but somewhat to the radial side. The reunion of the divided ends of the tendons, and the subsequent elongation of the connecting material may be usually effected by means of a common wooden splint and bandage; but in severer cases, an apparatus of iron and cog-wheels may be substituted.

The constitutional treatment of cases of hysterical contraction of the hand must be varied according to circumstances. The advantage of fresh air, daily exercise, and good nourishing food, needs no comment. As regards medicines, I find that when the patient is hot, restless, and thirsty, and the night's rest is disturbed, the potassio-tartrate of antimony given in small and not increasing doses (gr. $\frac{1}{20}$ to $\frac{1}{16}$) over a considerable period is of benefit to the patient.

In other cases of this kind, where in combination with spasmodic contraction there is a capricious state of the appetite, with pain after taking food, the trisnitrate of bismuth, given in doses of five grains to a scruple three times a day, may act with advantage.

Any tangible disturbance of the uterine functions must be corrected; the presence of worms in the intestinal canal should be removed.

The local employment of stimulating liniments over the spine and the affected limb is to be recommended. Also the use of the shower bath and of cold sea bathing. By steady perseverance in this course of treatment a successful result is often obtained in cases which at first appear unpromising.

We meet, in orthopœdic practice especially, with a group of cases called "spasmodic," in which the patient suffers from involuntary contractions of the whole limb. For instance, the thighs are semiflexed, the knees bent and partially crossed, the heels raised, the foot in the position of talipes equinus, or equino-varus. But all the parts are warm and tolerably well nourished, although the muscular fibres may be pale and deficient in tone. The gait of such persons is irregular, and they require the support of an arm or the aid of a stick. In severer cases the same morbid condition extends to the arms and hands, and the person can neither write, nor draw, nor feed himself.

This condition is quite different from that of congenital talipes, in which the limb is fixed and firm, and the muscles act healthily and normally as far as they can. Neither is it in any way allied to the paralysis of one set of muscles and the preponderating action of their opponents, as in talipes equinus paralyticus. We have here a want of combination and harmony of muscular action, and physiological research would point to the cerebellum as an organ whose functions were incompletely performed and disturbed. Young persons, the subject of these affections, are in some cases born prematurely, and the whole encephalon shows manifestly signs of weakness. From the time when the child tries to speak it displays extreme excitability, being easily frightened, easily moved to laughter or to tears. In other cases it is dull, morose, and deficient in natural affections. It can learn a little very quickly, and forget it at once; or it may refuse to repeat what it has learnt in spite of threats or endearments. I well remember the frightened, angry eye which one of these children always turned on me after my performing on it a trivial operation: no explanation could remove the feeling of animosity from the patient's mind. All these symptoms may exist, however, without spasmodic contraction of the muscles; and, on the other hand, the state of spasm may be present in a child whose intellect is fully up to the average, or, indeed, beyond it.

The seat of disease, or of arrest of development, is, I presume, in the cerebellum and mesencephalic portion of the spinal chord. We witness it as a congenital affection, or it may follow some of the febrile affections of infancy.

It is to the two very different conditions, namely, paralytic equinus and spasmodic contraction, that Bierbaum refers, when he divides the paralysis of children into two varieties, the idiopathic and the symptomatic. The symptomatic paralysis depends on functional or organic disturbance of the brain or chord. In the idiopathic form the nervous centres are free and unaltered. The intelligence, consciousness, and functions of the senses are disturbed in the symptomatic, but not in the idiopathic. It is equally common to either sex: it does not attach itself more to the right side of the body than to the left. But the lower extremities are far more frequently affected than the upper.

It was remarked by an early observer, that when the attack limits itself to the spinal chord, the lesion being complete, there is immediate withering and atrophy of the muscles. But when the attack affects chiefly the brain or the cerebellum, there is, it is true, muscular contraction, spasmodic and irregular action, flexion of the arms, knees, and feet, but no muscular atrophy.

In considering what can be done for the relief of these conditions, the first point for the surgeon to determine is the amount of power still held by extensors; if they are so far paralysed as to be beyond the control of the will, little or no good will be done by surgical operation. If, on the other hand, they still contract, though feebly, the patient may derive benefit from tenotomy and subsequent extension. But in all cases an apparatus to support the patient must be worn during life.

The following is a case of congenital spasmodic disturbance. Catherine L——, aged 9½, the daughter of a respectable tradesman, was brought to me Nov. 20, 1862, suffering from talipes equinus of both feet, contractions at the knees, and general spasmodic action of the muscles. She walked in an irregular and ungainly way. The mother said, that in consequence of a fright which she sustained from a horse, she was prematurely confined, and that the child in question was born at the sixth month fourteen days. It was very small, weighing only two pounds. It lay motionless, and did not open its eyes for many days. At the second and third month the child used to scream violently every night. It never walked like other children, but the present condition was not noticed until the eighth year.

She has talipes equinus of both feet, and contraction of the knees: both limbs are cold, but not withered. When first taken from bed she was not able to stand at all, because of the dragging of the muscles of the calf. Some power was gained after a time, but she often fell backward suddenly and bruised herself. She was quick in understanding common things, but had no power of application. She was very nervous and timid, and had never been pressed with books. She read a few sentences from the Bible, probably learnt by heart. In her sleep she started very much. She did not show much steadiness of affection. I divided both Achilles tendons, and by proper treatment brought the heels down so as to enable her to walk with the soles flat upon the ground; but for many months there was no improvement in her general condition. About the end of 1863 I saw this patient again. She had persevered in walking, and had gained much power over her muscles. The remedies which she had taken were small doses of tartar-emetic so long as febrile symptoms prevailed, and the nitrate of bismuth at intervals. Six months afterwards she was so much improved in health and general condition, that she paid me a visit to express her gratitude.

In all these cases, as I have already said, the amount of benefit depends on the degree of development of the nerve centres, or the extent of the lesion which they may have sustained. It is of no great use to cut the tendons and redress the foot of a half-idiotic child; nor is it wise to attempt an operation while febrile symptoms exist. The general health may need supervision: decayed teeth may need removal; heat of skin and disturbed digestion may be relieved by antimonials and mild purgatives. The heels may be brought to the ground by the division of the Achilles tendons; the knees and the thighs may be rendered straight by apparatus and tenotomy when needful; but the child must for the most part wear the irons for life, especially in those severer cases where the limbs are gathered together, and the child "squats" on the ground unable to rise, and dependent on others for aid in all the functions of nature.

In some of these cases benefit has been derived from small doses of bismuth, and in others quinine and general tonics. Moral influences may be brought to bear. The principle should consist in firmness without harshness; much may be done by judicious kindness in the correction of faults of temper or unpleasant habits. Parents must restrain their feelings of disappointment at witnessing the shortcomings of a child whose intellectual capacity is below the average; and teachers must remember that severity may upset the feeble amount of intellect which the child possesses. The study of all objects which are presentable to the external senses should be forwarded; all kinds of bodily exercise promoted. But the fact should ever be remembered that the fault lies in some hereditary parental defect for which the patient, at least, is blameless.

In cases of confirmed contraction of the limbs, in which the muscles are white and fibrous, the tendinous structures contracted, the temptation on the part of the surgeon to set the parts straight by forcible extension under chloroform is often very great; I would urge the surgeon to resist the impulse, and to adopt the slower course of gradual extension.

In 1862 a young girl, aged eighteen, was under my care in St. Bartholomew's Hospital, suffering from talipes equino-varus of both feet, and general spasmodic contraction of the knees and hips, following an extensive burn on the buttocks, received in infancy, by which the equilibrium of the nerve force to the lower limbs had been disturbed. While an infant, she submitted without murmur, under her mother's care, to her calamity; but when the menstrual function commenced, the annoyance proceeding from the fixed, contracted condition of the thighs became intolerable. There were difficulties in the way of obtaining an expensive apparatus, and the girl herself was morbidly anxious for immediate relief. Accordingly, I directed that she should be rendered insensible by chloroform, and proceeded to forcible extension. The resistance readily yielded; the limbs became straight, and it was found that the articulations of the hip and knees were normal. An opiate was given, and for some days all went on favourably. Within a week, however, swelling of the lower extremities supervened; patches of erysipelatous inflammation spread from part to part, and the patient died comatose. Although no examination of the body was allowed, I believe that in the extension some important veins were torn.

WRY-NECK.

Wry-neck, or torticollis, generally proceeds from contraction of the sterno-mastoid muscle. This contraction may affect the sternal portion, the clavicular portion, or both combined; or the whole muscle may be shorter and smaller than natural. The affection may be either congenital or non-congenital. In other instances the splenius muscle of the side opposite to that of the sterno-mastoid is also involved. Such was the case in a patient of mine, a gamekeeper, in whom the head was frequently brought into one position by the use of the gun. Wry-neck proceeds in other cases from irritation of the spinal cord produced by disease of the bones. In 1860 I saw a young lady thus affected. The mother brought her to me in consequence of deformity in the neck; and it was by examination that I discovered angular curvature of the spine, proceeding from caries of the bodies of the vertebræ at the junction of the dorsal and lumbar region. A mass of enlarged and tender cervical glands will produce a temporary twisting of the face and neck; so will cold, swellings of various kinds, cicatrices, paralysis of one set of muscles.

Wry-neck occurring in the young produces, if not corrected, singular changes both in the bones of the face and the spine. It drags down the features of the affected side; the line of the jaw is altered; even the orbit is on a lower level than that of the opposite side. The spine becomes the seat of confirmed double-lateral curvature. The clavicle is sometimes more convex than natural.

Cases of congenital wry-neck have been said to proceed from injury to the sterno-mastoid muscle at birth, *i. e.*, either by turning or by irregular presentation and pressure. I often meet with cases in which this muscle has been torn and swollen at the point of injury, but have not yet been able to connect the accident with the deformity in question. But such an event is quite possible. I fully agree with Dr. Little that the theory is untenable which would attribute wry-neck to accidental uterine or pelvic pressure. Congenital wry-neck clearly originates from causes acting through the nervous system or from arrest of development, or from the effects of injury at birth. A non-congenital and spasmodic form of wry-neck is not uncommon in practice among adults, in whom it seems to proceed from disturbance of the nervous system.

Emily ——, æt. twenty-four, a good-looking intelligent girl, attendant in a large lunatic establishment, turned her head one day sharply round to see something going on among the patients, when she found herself unable to bring the head back to its usual position. I saw her some time afterwards, and, imagining that the distortion proceeded from a sprain, the effects of which would soon pass away, ordered rest, and the employment of a liniment containing ammonia and opium. Several months, however, elapsed without any apparent change. She could at times keep the face for a few moments straight before her, and any one could so hold it; but on the support being removed, the sterno-mastoid muscle became tight, and the abnormal position recurred. The face being spasmodically moved, she found difficulty in feeding herself, and was vexed at the unsightly and inconvenient deformity. Instrumental treatment was tried without the least benefit. I then saw her, with Mr. Lawrence, and we determined to divide the sternal portion of the sterno-mastoid muscle. The relief effected by the operation was immediate as regarded the spasmodic movement of the head. I saw her some months after in perfect health, and quite restored. She had worn the usual apparatus of extension for about four months; during the same period she had taken steel medicines, her general health had improved, and convalescence was perfect.

The operation should not be undertaken without due precautions. The large veins at the root of the neck are not always regular in their distribution: when wounded, they pour forth large quantities of blood from orifices more patent than in other situations. Cases have occurred in which death has ensued from tetanus two to three days after the operation. The particulars of one was mentioned to me as having occurred in the United States, by the late Dr. P. Smith of Wimpole Street, formerly of Virginia.

In the performance of the operation of dividing the sterno-mastoid, a puncture should be made through the skin, and the division of the tendon completed by a blunt-pointed knife. Among the large veins at the root of the neck pursuing an irregular course, there is one especially which unites with the anterior jugular vein on the sterno-thyroid muscle. A wound of such a vein might prove fatal. The best spot is from a half to two-thirds of an inch above the clavicle. The puncture should at once be covered with a pledget of lint, and the patient put into bed, to remain there till the wound has healed.

Some surgeons treat wry-neck by means of apparatus only. I think that, except in very slight cases, the results are more unsatisfactory than by operation. But the apparatus is useful to extend the recently-united tendon after tenotomy of the sterno-mastoid. If both sternal and clavicular portions have to be divided, two separate punctures and operations must be performed.

In cases of wry-neck dependent on caries of the bodies of the vertebræ the treatment must be directed to the morbid condition of the spine and the irritation dependent thereon. In young women cases of hysterical character are occasionally met with. It is then better to rely on remedies suited for the uterine complaint; but mechanical treatment must be conducted on the principle already laid down—namely that of slow and painless extension. Dr. Little observes: "In young and flexible subjects we have found adhesive-plaster and a common roller-bandage an amply sufficient mechanical contrivance to aid in rectification of the head. Apply a long strip of adhesive-plaster around the forehead and occiput, its maintenance in position being better secured by a bandage passed over the vertex and beneath the chin, the two being pinned together where the one passes over the other, above the ears. Next, attach around the waist a broad band of adhesive-plaster, not so tight as to interfere with the movements of the ribs; over this a turn or two of calico roller-bandage; the two should be fastened together by a stitch here and there. The surgeon has now two circular bandages—the one around the forehead, the other around the waist—which are not likely to slip if properly applied. He should then sew a strip of ribbon to the head-bandage directly above the ear of the unaffected side, and carry it diagonally across the trunk to the opposite side of the waist-bandage, and then pin it. By this means the left sterno-mastoid process (we are speaking of wry-neck caused by contraction of the right sterno-mastoid) will be drawn towards the right sterno-clavicular articulation, the original wry-neck be removed, and the chin brought to the median line, or, in young and flexible subjects, even across it, towards the affected side, constituting a temporary wry-neck in the opposite direction."*

An apparatus which will drag on the contracted muscle by a leather strap passed under the chin, is, however, more certain in its action, and less irksome to the patient. The head is received in a semicircular bar of padded steel, which extends round the occiput from one temple to the opposite: from the extremities of this bar a chin-strap passes, capable of being tightened at pleasure. This bar is attached posteriorly to an upright piece of steel, which forms part of an instrument which is a modification of the spinal apparatus described in p. 179. The semicircular bar of steel admits of being raised, or depressed, or turned to either side by means of cog-wheels properly inserted. This instrument may be so constructed as not only to raise the head and extend the contracted sterno-mastoid, but also, by means of movable pads, to work at the same time on the curvatures of the spine.*

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* "On Orthopædic Surgery:" 'Holmes' System of Surgery,' vol. iii. p. 594.

I prefer this method of treatment to that of manipulation, which, however, may be used as an adjunct. Manipulation is thus managed :—An assistant holds the shoulders down; the surgeon, standing behind the patient, who is seated, applies firmly his flat hands to the sides of the head, and directs the chin, vertex, or occiput in the required directions. Such manipulations need to be done with due caution and technical skill. They should be repeated three times a day.

Some surgeons have professed to cure cases of wry-neck by galvanism. Of this I have no experience.

SPRAINS.

A sprain may be unattended with any visible lesion, or, on the other hand, may be accompanied with laceration of the synovial membrane, of the ligaments and tendinous sheaths, and of the muscles. In severe cases there is both swelling and considerable effusion of blood; or inflammation may supervene.

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* This apparatus is made by Messrs. Fergusson, of Giltspur Street.

All persons are liable to sprains, but not equally so. A strong, lithe, well-made, active young man, rarely experiences such an accident, however he may exert himself; while on the other hand, a delicate woman may sprain either the hand or wrist on making any slight unaccustomed exertion. Moreover, the existence of any deformity renders a person particularly liable to sprains, from the fact that a greater stress is thrown on ligaments than they are intended to bear.

Talipes equinus is a common deformity. In many cases it proceeds from contraction of the muscles of the calf in a shortened and partially paralysed limb. The patient walks on the distal extremities of the metatarsal bones, the heel raised several inches from the ground; he cannot rest firmly on the sole. The great annoyance which he experiences is the liability to sprains: if he treads on a stone or any irregularity of surface, he gives the ankle a wrench which lays him up for a fortnight or more.

Or a patient may be the subject of flat-foot (talipes valgus), when he walks on the outside of the foot to spare himself the pain which ensues in ordinary progression (when he puts the sole flat on the ground, and throws the weight of the body on the calcaneo-scaphoid ligament). In walking, such a person may easily sprain the ligaments of the ankle, generally the external lateral ligament, which is more or less on the stretch.

Excessive weight predisposes to this accident. In 1863 I saw in St. Bartholomew's Hospital a woman, aged thirty-eight, whose weight was 24 stone 11 lbs.: she measured twenty-four inches round the calf of the leg; her appetite was small; she had had thirteen children. Her breathing was laboured, and locomotion was always attended with danger of falls and sprains.

Bonnet rightly observed, "The surgeon may be called to treat a sprain, (1) when the lesion is recent, a day or two after the accident, when the inflammation has not had time for development; (2) some days after the accident, when the inflammatory phenomena exist in all their intensity; (3) after some weeks or months, when the disease has passed into a chronic state. The methods to be selected differ widely in each of these periods." *

Treatment of a recent Sprain.—The first act of the surgeon should be to ascertain the extent of the injury; but he must accomplish this without putting the patient to much pain. It is desirable to ascertain whether, in a sprained ankle, the malleoli are broken, but it is far more important to be sure that the foot is in its proper relation to the bones of the leg. The time which must elapse for recovery from a severe sprain will suffice in many cases for the reunion of broken bone. In the case of a sprained wrist, the lower end of the radius may be broken; but the surgeon should not manipulate for crepitus between the broken ends of the bone, a proceeding often unavailing and always injurious. He should tell by his eye the character of the injury. Moreover, there is one sign of a fracture of bone, which will rarely mislead, namely, fixed and deep-seated severe pain on pressure at the seat of injury.

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* 'Malad. Articul.,' p. 72.

The older surgeons were too fond of manual examination. "When I am called," says Ravaton, "to a person who has a sprain, before swelling has supervened, I never fail to have extension made by some strong assistants. Should the sprain be either at the wrist or foot, I carry the palm of my two hands with the fingers crossed and press in every direction to push the bones, if they be displaced, into their proper situation; I slide my fingers over the extensor tendons to put them in place, if they have sprung over the border of their sheaths, as I have seen on many occasions; I flex and extend the articulation, and then proceed to the dressing." *

The great fact to ascertain is that the parts are in their normal position, and this is accomplished by gently trying in a limited degree the natural movements. Neither pressure nor friction will exert any useful influence on the strained and sometimes torn parts.

Applications.—The practice of English surgeons is to treat a sprain by rest, and the application of cold in the form of an evaporating lotion, or a bag of pounded ice. If the ankle be the part affected the patient is confined to bed and a wet cloth is laid on the limb, which lies uncovered. By these means the temperature may be so much diminished that the part may even be chilled. In a healthy subject the effects of the sprain pass away in a few weeks, but the limb may require the support of a bandage for some months afterwards. Poultices are rarely employed unless the part becomes hot, red, and swollen. Bonnet seems to entertain a great dislike to poultices: "They do not sooth the patient, and far from combating heat and inflammation, they favour its onward march, and combine in producing a passive stasis often difficult to overcome after sprains." He objects likewise to the application of leeches, affirming that they in fact determine sanguineous congestion. M. Baudens affirms that if every practitioner published the result of his cases, we should be compelled to recognise the imperfections of treatment having as its basis the use of leeches and cataplasms. "On a total of seventy-eight amputations of the leg and foot, my own private statistics, and not including those which have been performed in the ambulances from the accidents of war, sixty had their origin in a sprain, eighteen alone being strangers to this cause. And while these facts passed, so to say, unobserved in science, they attracted particular attention from the Council of State, upon whom devolves the duty of inquiring into the retiring pensions of soldiers who have been deprived of limbs by amputation." *

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* 'Pratique moderne de Chirurgie,' t. iv. p. 227.

In 1848 the Council of State addressed to the Minister of War a letter containing the following reflexions. "Under many circumstances sprains received during the events of war, or in the public service, and which at first appeared of little importance, have at a later period rendered necessary a long residence in hospital, and finally have led to amputation of the limb in order to preserve the life of the soldier; and the documents show that in the greater number of these cases the soldiers have either not been transported at once to the infirmaries, or that they have resumed their duties too promptly."

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* 'Mémoire sur l'Entorse,' lu à l'Académie des Sciences, 24th May, 1852.

We shall not in this country attribute this disastrous result to the treatment by poultices. Such applications are perfectly harmless, and are useful only as a means of conveying warmth. But they are cumbersome, and on that ground not very often used. The statement, however, above quoted, serves to illustrate the necessity of imposing perfect rest for a considerable time after the receipt of the accident.

Repercussive remedies.—Bonnet remarks that the inflammation which follows a sprain, being accidental and constituting one of the worst consequences of violence done to a joint, the evident indication is to prevent it if it be not yet developed, and to drive it back (*repercuter*) if it already exist. In order to obtain this end, cold and astringent applications are necessary.* He gives some good directions regarding the employment of cold lotions; namely, to put them on the part in such a way that the fluid can evaporate. He remarks that a wet compress bound on the limb and covered up serves rather to elevate the temperature. Such directions are well understood in this country.

Irrigations of cold water are among the most useful means of reducing the temperature: so also the application of freezing mixtures. Dr. James Arnott has done good service in bringing this method of treatment more prominently forward in its various ways.

The following is an instance of morbid changes brought on in the ankle by over exertion, and by sprains, in a subject otherwise unhealthy. A limb was amputated by Mr. Lawrence, November 24, 1849. The skin was thin and discoloured, and under it there was a considerable layer of fat, to which was owing some œdema at the outer ankle. The sheath of the peronei tendons was looser than natural and thickened. The inner ankle was occupied by a large ulcerated surface, the size of a shilling-piece, leading to denuded bone. Upon the reflection of the integument, matter poured forth from under the tendon of the tibialis posticus muscle. The lower part of the tibia was soft. The internal lateral ligament soft, weakened, but entire. The synovial membrane was converted into a pulpy, brownish-coloured, thick mass, projecting both above and below. There were large abscesses on the dorsum of the foot communicating with the joint. Upon laying open the articulation I found the synovial membrane hanging like a fringe round the lower extremity of the tibia. The articular cartilages were partly absorbed, partly loosened by disease commencing in the bone. Under the cartilage and springing from the bone, there was a layer of light reddish-coloured vascular granulations. There was pus in the interior of the joint. The same morbid changes were observed in the calcaneo-scaphoid articulation, particularly affecting the astragalus. The disease seemed to have commenced in the astragalus, on which bone the weight of the body is transmitted.

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* 'Traité des Malad. Artic.,' p. 78.

How do we treat "sprains" in an hospital? The answer is, by rest. The patient is put into bed and kept there. Inflammatory symptoms are combated by the application of cold. Leeches may be sometimes required, but after rest the application of a bandage to support the vessels and to prevent œdema is invaluable. The common calico roller is preferable to the elastic, as being more unyielding. In many cases strips of adhesive plaster may be applied round the limb under the roller.

It has been remarked that, "although cold is one of the oldest of medicinal applications, and almost an instinctive one, there has always been a very general prejudice against it. The introduction of a cooling regimen in fevers, &c., in lieu of the 'hot and sweating' one was a greater triumph achieved by Sydenham than his overcoming the prejudice against Jesuits' bark as a remedy for ague; and even at the present day, notwithstanding the declaration of a learned German Professor of Surgery that he would abandon his profession if deprived of the use of cold, the tendency is not altogether confined to nurses to substitute warm drinks and fomentation for cold ones, in cases where the latter are the appropriate remedy. It is only the craving of the patient for cold drink in cholera that has prevented the administration of hot potations in lieu of iced water, the best if not the only useful remedy for it hitherto exhibited; and, had warm application been as accessible to military surgeons, as cold ones, the latter might not have attained their present high reputation in the treatment of gunshot wounds." *

Ruptured ligaments unite in the same manner as the divided tendon. In the event of the patient being kept at rest, so that the process of repair is not interfered with, the restoration of the joint is perfect.

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* 'Contributions to Practical Medicine,' &c., by James Arnott, p. 9, Sect. II., 1864.

CHAPTER XI.

INJURIES OF JOINTS.

All injuries which involve joints require great attention. Although cases may do well under judicious management, yet very frequently inflammation of a serious kind arises, which leads to changes in the synovial cavity sufficient to deprive the patient of the power of motion, or induces such general disturbance as to destroy life.

Inflammation of a joint may be produced by a blow or bruise. It sometimes is limited to the synovial membrane, producing effusion into its cavity. In other instances the inflammation is more general, causing swelling, inability to move the part, heat, pain, and external redness, and the membrane feels thicker than natural.

We must distinguish between those cases in which a joint swells in consequence of an injury, and a swelling that affects merely the external parts. In the latter case, the pain may be more acute, but the constitutional disturbance is less: the movements of the joint are not so much impaired, the external swelling is red. When the joint itself is inflamed, the swelling assumes a certain definite form: there is heat, but no external redness; the movements are very limited indeed. But at the same time, the two kinds of inflammation may be combined. In speaking of wounds of joints, the late Mr. Hey, of Leeds, observed, "The utmost care should be taken in these cases to prevent inflammation. Upon this circumstance, chiefly depends a successful termination. I have seen many large wounds of joints heal without the supervention of any dangerous symptoms, where due care has been taken to prevent inflammation; whilst injuries apparently trivial will be often followed by a train of distressing and dangerous circumstances where such care has been neglected. It is generally easier to prevent inflammation in the joints after a wound, than to arrest its progress when once began. I speak now of inflammation affecting the synovial membrane. A slight degree of redness and tenderness in the integuments only is of little consequence; but when the synovial membrane becomes inflamed, the formation of abscesses, attended with a high degree of fever, and ultimately a stiffness of the joints, are the common consequence, if the life of the patient is preserved."*

Penetrating wounds, *i.e.* those which reach the cavity of the joint, are dangerous in proportion to the size of the articulation. They are in all cases serious, but when involving joints of the first magnitude, their importance cannot be over estimated.

As I have already spoken of the morbid changes which ensue in acute inflammation of joints, I shall here limit my remarks to the surgical treatments of wounds. It must be remembered that in these cases, inflammation may rapidly proceed, to the complete disorganisation of all the articular tissues.

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* Hey's 'Observations on Surgery.'

We judge whether a joint has been punctured by observing the particular situation, direction, and depth of the wound; and by a further circumstance, the escape from the wound of synovia, a thick and viscid transparent fluid of pale yellow colour, of the consistence of oil. There are, of course, tendons inclosed in sheaths containing a similar oil near certain joints, and some of these sheaths may communicate with the articulation. In most cases, the inflammation of the synovial membrane, accompanied with effusion of serum into the articular cavity, following a blow on a joint without a wound, gets well by rest, by the use of cooling lotions; and perhaps the local abstraction of blood by leeches. But this last remedy is by no means commonly necessary. We very commonly employ pounded ice, or freezing mixtures.

When, however, the articulation has been opened, the wound, it is true, *may* close without trouble, especially in the young; but much more commonly we have to encounter symptoms of the most troublesome, and perhaps violent character. The severity of the attack by no means depends on the size of the wound. A man once came to the hospital about mid-day, having just run a long nail into the knee. He seemed agitated by the accident, but declined to remain in the hospital, though warned of the probable nature of the accident. Towards the evening of the same day he was seized with a violent rigor, and sickness; the skin became hot, the tongue furred, and the pain in the joint excessive. Under proper treatment these symptoms subsided; but he left the hospital after six months of suffering with a stiff and unsound limb. Any exertion brought back a recurrence of the heat and pain. Nor could he walk far without discomfort and the aid of a stick.

Whenever we have reason to believe that a joint has been wounded, whether by a puncture or an incision, our first duty is to close the wound; our second, to put the patient in bed, and keep him there; our third, to quiet apprehension and alarm, and to secure him rest, if necessary, by the administration of opium.

In these cases sutures are not usually required, but they may be applied if thought necessary. The best way to close the wound is by means of slips of adhesive plaster, a quarter of an inch wide, carefully applied over the well-adjusted edges. Over this, a thin layer of collodion may be spread by a camel's-hair brush. The limb should be in a semiflexed and easy position; a splint is not absolutely necessary. If used, it should be made of tinned iron, well padded, so as to be bent and moulded according to the patient's feeling. Instead of an evaporating lotion, an apparatus can be easily constructed to reduce the temperature of the limb by the irrigation of cold water. The diet should be nutritious, but not stimulating; the daily action of the bowels should be maintained.

The causes of the grave character of these injuries are not, perhaps, quite clear. I do not think that they are explained upon the supposition of decomposing pus in the cavity of the articulation; nor are the symptoms in unfavourable cases those of blood-poisoning from absorption of morbid matter. It would rather seem that a wound of a large synovial membrane, like that of any large serous membrane, is often followed by inflammation of the most violent character, and that this inflammation is propagated to the cancellous tissue of the head of the bone, which throws off its layer of articular cartilage, and thus produces the complete disintegration of the joint. It is not easy to explain why such a chain of accidents should so readily and so frequently occur, inasmuch as the connexion between the synovial membrane and the bone is not intimate by any special vascular supply.

The way in which injuries to joints cause death may be illustrated by the following case :—A little girl, fourteen months' old, was brought to the hospital in extreme pain in the right knee-joint, which was hot, swollen, semiflexed, and hard. The only explanation was that she had had a fall about one month previously, and that the swelling had supervened on the injury. Since the fall she had become greatly emaciated; the swelling involved the lower part of the thigh. Admitted March 16. A large abscess in front of the femur was opened. 17th.—The opening was enlarged, and a still larger quantity of pus escaped from the joint: the parts in the popliteal space were hard, hot, and swollen. 20th.—Another abscess was opened. Wine and nutritious diet were freely given, but the child ultimately died exhausted by profuse discharge.

In these cases the pus is usually free from unpleasant odour, though abundant. There are no signs of decomposition, nor is there any fœtor, unless the bone becomes carious or necrosed. Death seems to ensue from pain, exhausting discharge of pus; from hectic; in the latter stages of the disease the limb becomes œdematous, but the symptoms which affect the patient generally are rarely those of "blood poisoning."

If it be correct to say that the severity of the symptoms in these cases depends, not upon the absorption of altered purulent matter, but on increased vascular activity, proceeding from the synovial membrane to the bone, and producing the usual results of acute joint-disease, then we shall not be surprised to find that the symptoms of pain and general disturbance may be relieved by the local abstraction of blood. And such, indeed, is the case. That pain which opium cannot alleviate, may be quieted by the application of eighteen to twenty-four leeches to the part, repeated in numbers of twelve and upwards daily. The argument that such a practice exhausts the patient is met by the statement that it is quite compatible with an allowance of generous diet, including beer or wine, as well as by the fact that the strength yields far more rapidly to prolonged pain and exhausting discharge. The wound once closed, the limb is to be supported by a bandage; and, in course of time, passive movements may be employed to restore the mobility of the joint. For this purpose the immersion of the limb in heated water or air (as hot as the patient can bear) is a most useful adjunct.

It has been affirmed that a wound of a joint made very obliquely, so that the opening into the synovial cavity is two to four inches distant from the wound of the skin, is very much less dangerous than a wound so inflicted that the opening into the joint is direct: the former partakes of the character of a subcutaneous operation, by which the admission of air is rendered impossible. This is true to a considerable extent. An opening made into a joint by a knife, three to four inches long, and introduced a proportionate distance from the synovial cavity, is rarely followed by symptoms of acute inflammation. But such a wound, if neglected, may be followed by symptoms of sub-acute character, involving not only the proper tissue of the articulation, but likewise the surrounding areolar tissue.

The following case illustrates the dangers attending an opening made into a large joint:—A boy, aged ten, was admitted into St. Bartholomew's Hospital, September, 1865, with great enlargement of the right knee-joint. There was a fistulous opening leading into the synovial cavity, from which a large amount of pus daily escaped. Mr. Thomas Smith, who at that time had charge of my wards, found upon inquiry that an opening had been made into the joint seven weeks previously by a surgeon who suspected suppuration of the synovial membrane. This operation had been followed by great aggravation of all the symptoms, and the patient was admitted into the hospital in a state of extreme emaciation and exhaustion. Mr. Smith examined the articulation, and upon introducing his finger into the cavity, found the patella necrosed and completely detached. In fact, it escaped externally during manipulation. The rest of the joint was converted into an irregular osseous and fibrous cavity, admitting of no repair. Under these circumstances he very properly amputated the limb. The case terminated favourably.

CHAPTER XII.

BURSÆ MUCOSÆ.

THESE structures have long been recognised by various authors. Weber observes ('Handbuch d. Anatomie,' B. i. S. 371), "wherever two muscles in their movements rub against one another, or one tendon against another, or when a tendon runs along a process or a groove of bone, there is found a bursa mucosa or a synovial sheath. In some situations a bursa mucosa lies between two bones, which, without requiring an absolute joint, may yet rub one against the other—as, for example, between the clavicle and the coracoid process of the scapula.

"A bursa mucosa is a synovial sac, more or less round in form, which surrounds the tendon, whose friction it diminishes to a greater or less degree; a synovial sheath, on the other hand, is a prolonged synovial sac, which may be continued into a canal. The external surface of these prolonged sacs or sheaths is applied to the surrounding parts, *e.g.*, to the groove in which the tendon plays."

The bursæ mucosæ of the subcutaneous tissue have received particular notice from the labours of Schreger and Beclard, also from the Monros of Edinburgh. They are found wherever the skin runs backwards and forwards over a hard, bony surface, such as the olecranon or the patella. They lie between the skin and the fibrous investment of a limb, are frequently subdivided by septa into spaces, and are like great spaces in the areolar tissue. In fact, as Beclard remarked, in those situations where a greater amount of movement is provided for, the areolar tissue is looser and more abundantly supplied with a lubricating fluid, and has between its layers great intervals or spaces, which are more or less like these subcutaneous bursæ.

Although in no situation can we say that an epithelial lining may not be formed, yet it is either wanting or less complete in the subcutaneous than in the deeper bursæ. The presence of these cells seems necessary for the *completer* secretion of that thick synovial fluid which is so abundantly poured out in the immediate proximity to a joint. Still more recently, both Kölliker and Virchow have investigated this subject. The former observes: "Where muscles or tendons rub in their movements against hard structures, such as bone or cartilage, or against other muscles, tendons, or ligaments, there is found between such structures spaces filled with a somewhat sticky or glutinous fluid, which, according to Virchow, is not mucus, but something very similar to colloid substance. These spaces anatomists have been in the habit of regarding as lined by a distinct synovial membrane: they form shut sacs of round or elongated form, which either simply cover the opposed surfaces of bones and tendons, or bones and muscles, &c. (bursæ mucosæ), or in the form of multiple yet connected tubes are reflected, first over the surface of the tendons, and, secondly, over the surface of those parts in which the tendons move (vaginæ synoviales). The truth is, that only the very fewest of these spaces are supplied with a continuous membrane; the greater number are without it. The bursæ so lined are those of the muscles, such as the psoas, iliacus, deltoid, in which a continuous sac is to be traced from the first. Those not so continuous are the bursæ of tendons in which a membrane can be seen only in certain situations, and is absolutely deficient in others. The same may be said of the synovial sheaths, among which those of the common flexors of the fingers and toes manifest only partially a trace of a well-formed serous investment.

In many situations the surface of the tendons is free from any serous covering. On these grounds we must receive the old doctrine of the prevalence of a shut synovial sac with caution. In most of these sheaths, and in many bursæ mucosæ, there are found here and there—for instance, on the retinacula—larger or smaller reddish-fringed bodies, which are vascular processes of the synovial membranes similar to those which exist in joints.*

The opinion thus expressed implies also that the subcutaneous bursæ are mere spaces in the areolar tissue, while those of the muscles are supplied with epithelium, and are more completely formed, yet that they cannot be regarded in the same light as the pleura or peritoneum, inasmuch as their epithelium is, with scarce an exception, never complete, and the proper fibrous layer of the membrane in many places is absent. In those situations where they communicate with a joint, the transition is gradual. Nevertheless we must not lose sight of the liability of these structures to inflammation and many other morbid processes which bear a close affinity to diseases of joints.

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* Kölliker, 'Gewebelehre des Menschen,' S. 179.

The melon-seed shaped bodies are, as Lebert has described them, smooth, of yellowish-white colour, and present, under the microscope, a stratification of irregular layers without distinct fibrous structure, and contain a quantity of globules without nuclei. When boiled, they dissolve in part, and, in burning, exhale an odour like burnt horn. But Lebert is in error when he affirms it probable that they owe their origin to a sanguineous effusion (*epanchement sanguin*) into the articular cavity, and that they become subsequently of their flattened, roundish shape by friction of the opposed surfaces. Equally erroneous is it to regard them in the light of hydatids. If examined with care, they will be found to be apparently of two varieties, namely, those with peduncles, and those without—the greater number of the latter variety. When free, and without peduncles, they are of yellowish-white hue, smooth, elastic, round, or oval, and flattened, varying in size from a pin's-head to a bean, covered with a slimy, slippery substance; their interior is mostly hollow, sometimes containing a fatty substance; their microscopic structure homogeneous, or nearly so. In other instances, two or more may be found attached to one peduncle; or, though free, a short or rudimentary peduncle may be detected. They must be regarded as proceeding from the synovial fringes found in bursæ and synovial sheaths, as well as in synovial membranes, the vascular tufts of which have undergone hypertrophy and fibrous degeneration. The hollow in the interior is the interval between the two layers of the reflected membrane. In the Museum of the Veterinary College at Berlin (No. 2817), some of these bodies were found in the subcutaneous bursæ mucosæ of a horse.

This mode of accounting for their origin is different from that expressed by the late Sir B. Brodie, who supposed that they were originally masses of lymph, either deposited in the shape in which they were found, or which had been divided and broken down after having been at first deposited in larger masses; and, indeed, the entire absence of any trace of a peduncle in many instances has led some modern authors (Hyrtl, for example) to conclude that these bodies are of two varieties, partly intra-, partly extra-capsular. Those formed in the cavity of the articulation, he says, never come into existence in a pedunculated state, are true coagulations of a synovia rich in fibrinous and albuminous material, and often show in a striking manner their concentric formation. Those which are developed external to the synovial capsule are fibro-cartilaginous concretions, which press the synovial membrane before them, drawing out a peduncle with their growth, and finally falling into the cavity of the synovial membrane by rupturing or breaking it.*

I do not consider these accounts to be perfectly satisfactory; nor do I conclude that the absence of a peduncle is sufficient to warrant the establishment of two varieties of these melon-seed shaped bodies. If in many instances we have an opportunity of examining the synovial fringes, which exist for purposes of secretion in all these structures, we shall find numerous fibro-cartilaginous appendages adhering to them, the number infinitely increased by making use of a low magnifying power. They are composed of two layers of the secreting membrane, in the normal state, abundantly supplied with blood-vessels. After they have undergone the fibro-cartilaginous degeneration, and attained the usual size, they drop off, the faint trace of the peduncle being soon lost. They retain, however, by the cavity in the interior the trace of the double layer of vascular membrane, out of which they were originally constructed.

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* 'Topograph. Anat.,' B. ii. S. 206.

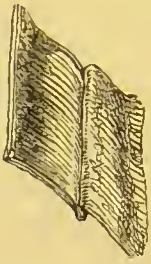
Fig. 12.—Section of piece of Fibro-cartilaginous Body, magnified.

The various "bursæ mucosæ" in the human body have been carefully examined by Mr. Holden ('Manual of Anatomy,' 1861). Although he may not have added to the list of those previously known to exist, he has yet marked out the anatomical relations with greater accuracy. These structures may form anywhere, when a sac containing an oily secretion, to facilitate movement between the parts, is required; but in some situations they are constant, and possess in greater degree the characters which ally them to a synovial membrane. Those commonly found in the upper extremity are as follows:—

a. A large bursa exists under the deltoid muscle, between it and the head of the humerus. It extends for some distance beneath the acromion and the coraco-acromial ligament, and covers the great tuberosity of the humerus. "I have seen it," observes Mr. Holden (Op. cit., p. 254), "communicating by a wide opening with the shoulder-joint; but this is a rare exception."

b. There are several bursæ about the tendon of the subscapularis muscle. There is one of considerable size on the upper surface of the tendon to facilitate its motion beneath the coracoid process and the coraco-brachialis:

this sometimes communicates with the large bursa under the deltoid.

c. Another is situated between the tendon of the subscapularis and the capsule of the joint, and almost invariably communicates with it.

d. The tendon of the latissimus dorsi muscle, where it is inserted into the bottom of the bicipital groove of the humerus, is about two inches broad, and lies in front of that of the teres major : between the two there is a large bursa.

e. The bursa between the integument and the olecranon is constant, and usually large; but it varies in size considerably.

f. There is a bursa between the "round ligament of the forearm" and the insertion of the tendon of the biceps. The round or oblique ligament is that thin band of ligamentous fibres which extends obliquely between the bones of the forearm in a direction contrary to the fibres of the inter-osseous membrane : its use is to limit supination of the radius.

g. The bursa of the carpus lines the under surface of the annular ligament and the groove of the carpus, and is reflected in loose folds over the tendons. It is prolonged up the tendons for an inch and a half or two inches, and forms a "cul de sac" above the ligament. Below the ligament the bursa extends into the palm, and sends off prolongations for each of the flexor tendons, which accompany them down to the middle of the hand. When this bursa is distended by fluid, there is a bulging above the annular ligament, and another in the palm, with perceptible fluctuation between them, the unyielding ligament causing a constriction in the centre. Mr. Holden has only met with one case in which this bursa communicated with the wrist-joint. He adds, "It communicates always with the synovial sheath of the long flexor of the thumb; in most cases with that of the flexors of the little finger; but rarely with that of the index, middle, and ring-fingers. On this account inflammation of the theca of the thumb or little finger is more liable to be attended with serious consequences than either of the others." (Op. cit., p. 241-2, note.) I have not verified this observation by experience.

h. Bursæ are frequently developed between the digital extremities of the metacarpal bones.

i. Small bursæ are sometimes developed in the cellular tissue over the knuckles.

j. Bursæ are irregularly formed over the external and internal condyle of the humerus; over the shaft of the ulna; over the styloid process, this latter sometimes communicating with the sheath of the extensor carpi ulnaris.

k. The surface of the flexor tendons and the interior of the synovial sheath are lined by a synovial membrane. This membrane is reflected from the sheath over the tendon a little above the metacarpal joints of the fingers; that is to say, nearly in a line with the transverse fold in the skin of the lower third of the palm. Towards the distal end of the fingers, the synovial sheath stops short of the last joint, so that it is not necessarily injured in amputation of the ungual phalanx. In the thumb the tendon is accompanied to the last joint by its synovial covering; consequently the sheath is injured by amputation of the last phalanx in this situation.

The bursæ mucosæ of the lower extremity most worthy of note are as follows:—

a. One, either simple or multilocular, where the tendon of the glutæus maximus plays over the trochanter major.

b. One of considerable size between the tendon of the psoas magnus muscle and the capsule of the hip-joint.

c. A bursa under the tendons of the obturator internus muscle.

d. A large bursa between the semi-membranosus muscle and the inner head of the gastrocnemius. This is generally an inch and a half to two inches long, and occasionally communicates with the knee-joint—"not directly," observes Mr. Holden, "but through the medium of another bursa beneath the inner head of the gastrocnemius."

e. The "house-maid's" bursa, or that one over the patella and its ligament.

f. A bursa between the ligamentum patellæ and the tubercle of the tibia.

g. One between the crureus muscle and the front of the femur, which often communicates with the knee-joint.

h. Bursæ about the great and little toes, generally situated between the skin and the sesamoid bones.

i. Bursæ between the tendons of the interossei muscles.

Respecting the synovial covering of the flexor tendons, that which was said of the fingers applies equally to the toes.

When we consider how constant are some of these bursæ, and how uncertain and easily formed are others, we may record the views expressed by Mr. Paget, that "two methods obtain as regards their formation." ('Lect. on Surg. Pathol.,' vol. ii. p. 45.) Some—of which the best example is the bursa over the patella and its ligament—are merely enlargements, with various transformations, of bursæ naturally existing. Not materially different from these are the bursæ which form anew in parts subjected to occasional localised pressure, and which appear to arise essentially from the widening of spaces in areolar or fibro-cellular tissue, and the subsequent levelling or smoothing of the boundaries of these spaces; but others, such as the bursæ or ganglions, which form about the sheaths of the tendons at the wrist, appear to be the cystic transformations of the cells enclosed in the fringe, like processes of the synovial membrane of the sheaths."

This view, however, which was shared by Rokitansky, has been questioned by other authors. The formation of cysts seems in most instances to proceed from dilatations of pre-existing tubes or ducts, or serous sacs, the traces of original structure being slowly effaced.

Diseases of the Bursæ Mucosæ about the Shoulder-joint.—In describing the diseases of the bursæ mucosæ of this region we must never forget the frequency of their communication with the shoulder-joint. The subscapular bursa is very often nothing more than an offshoot from the synovial membrane, and contains a precisely similar fluid. In other instances, however, this communication does not exist; and in one case, described by Hyrtl ('Med. Jahrbb. d. k. k. österr. Staates,' Bd. xxxix. 1842. S. 261), it formed, in an old woman, a tumour the size of a pigeon's egg, which had rendered atrophied by pressure that part of the muscle on which it pressed, and contained a firm gelatinous mass, in which were eight free bodies about the size of apple-pips.

Diseases of the Bursa Mucosa under the Deltoid Muscle.—This bursa is liable to inflammation, unconnected with disease of the synovial membrane of the shoulder-joint. The cavity may contain pus, and the interior be lined with lymph. Gurlt affirms that the sub-deltoid bursa and the synovial membrane of the shoulder may be simultaneously affected, each cavity distinct and containing a fluid of different consistence; but that in such instances the fibrous capsule is thickened (Gurlt's 'Beiträge zur patholog. Anat. d. Gelenkkrankheiten,' S. 241); when a communication exists between the two, disease is easily propagated from one to the other. The possibility of such a communication should ever be before the surgeon's mind, and should influence him in his proceedings. In the event of the bursa of the subscapularis being filled with pus, an opening may, indeed, be necessary; but the discharge of the fluid imperfectly relieves the patient. The shoulder-joint is often implicated in the mischief, and may in bad cases ultimately require the performance of some surgical operation, such as the removal of the head of the humerus.

In the Museum of St. Bartholomew's Hospital there is a specimen exhibiting an enlargement of the bursa between the deltoid muscle and the capsule. The lining of the bursa is smooth, like the surface of a mucous membrane. It contained numerous flat oval bodies. (Ser. V., No. 12.)

Diseases of the Bursæ about the Wrist-joint.—In an examination of the bursæ connected with the flexor tendons at the wrist, Hyrtl found the fibrous layer of the membrane much thickened and 117 of these bodies within.* Most of them were flat; some very few were globular; some had short peduncles. Between the serous and fibrous layers of the membrane little knots were accumulated, which, pressing on the inner surface of the sac, gave it a warty appearance. Some of these knots so projected into the sac, pressing before them the lining membrane, that they looked like small bags hanging by a slender peduncle. Their mode of origin could be best studied in that part of the sac which corresponded with the interval between two of the flexor tendons, where there is usually an imperfect vascular septum. All the bodies which had peduncles, or were still attached to the sac, were small. Some which were free had the shape and size of a coffee-bean.

In the Museum of St. Bartholomew's Hospital we find the following preparation: "Part of a hand and forearm, in which the sheaths of the extensor tendons of the finger and thumb have been greatly enlarged by the accumulation of fluid containing small cysts. The diseased sheaths are laid open, and one of them is shown extending up half the forearm. The walls of the sheaths are thickened; their internal surfaces, in many parts, granular, or like mucous membrane. The partitions between some of them appear to have been absorbed, so that several form one cavity (Ser. V., No. 19).

Mr. Jonathan Toogood relates the case of a delicate little boy, who was brought to him from a considerable distance, with a large ganglion on the flexor tendons of the wrist extending into the palm of the hand. "I have generally got rid of these effusions," he observes, by a smart blow, which has burst the sheath, or, where that could not be effected, by blisters; but this is a tedious process. As I could not adopt either of these plans in this case, I determined to paint the whole over with a saturated solution of iodine, which completely removed it in about seven or eight days.* But the effect of the application of iodine may be to excite acute inflammation, terminating in suppuration. A case came before my notice in which, after similar treatment, the bursa over the patella suppurated; when opened, it poured forth eight ounces of well-formed pus mixed with blood.

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* 'Medicin. Jahrbb. d. k. k. österr. Staates,' Bd. xxxix., 1842, S. 261.

Enlargement of the Bursa over the Patella.—The amount of fluid in some cases is very considerable. I have evacuated by lancet-puncture as much as eight ounces of dark-red serous fluid. On examination afterwards a solid mass was felt under the skin. Some surgeons affirm that the bursa usually enlarged is one over the ligamentum patellæ. This is an error. The cavity is sometimes nearly filled by fibrous tissue and connecting bands.

Enlargement of the bursa over the olecranon is common in working-men. Among the coal-workers it is called the "miner's elbow." Velpeau has seen one filled with small loose fibro-cartilages.

This bursa is occasionally wounded in consequence of falls, blows with sharp instruments, &c., and, when injured, it is extremely liable to inflame, possibly partly from the frequent movements of the limb, in which case the inflammation spreads, both upwards and downwards, into the areolar tissue, and especially in the latter direction, causing great swelling, heat, and tension, and proceeding in many cases, if unchecked, to phlegmonous erysipelas in an aggravated form. A gentleman, carelessly entering a darkened room, fell over a chair, and, striking his right elbow against some glass, received a wound which opened the bursa over the olecranon. He was sufficiently aware of his danger to have the wound immediately closed and to keep the limb at perfect rest. On the third day the wound was in great part closed, but the whole limb felt heavy and the patient was out of spirits. On the fourth day he went out of town to "get some fresh air," but found that he was easily tired, and that his appetite was completely gone. On the fifth day the whole limb was hot, heavy, and painful, and there was evident fluctuation in the bursa of the olecranon. He was unable to use the hand without pain. I immediately laid open the bursa, giving free exit to its contents, and directed the patient to remain in bed and to keep the limb raised on a pillow. So great was the tension before the operation that the skin was numb, and the patient scarcely felt the introduction of the knife. There was some hæmorrhage, but to no great amount. The relief was immediate and permanent. Towards evening all unpleasant symptoms had subsided, and in the course of two or three days this gentleman resumed, with care, his usual avocations.

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* 'Reminiscences of a Medical Life,' p. 101. 1853.

Treatment by Injection.—The treatment of enlarged bursæ by the injection of iodine, generally in the form of tincture, diluted with one-half or two-thirds of its bulk by water, has been strongly advocated by some surgeons, and favourable results have been recorded.

But iodine, however useful in effecting the absorption of effused fluids, acts not uncommonly as a severe irritant when injected into the cavity of a fibrous or fibro-serous cyst; it excites inflammation in the fibrous membrane and in the adjacent areolar tissue; the skin becomes hot, red, and tense, and matter forms, which makes its way slowly to the surface. When we remember in connection with this accident the proximity of the joint, we must recognise another objection to this method of treatment. It is not, at least, suited to the treatment of deep-seated bursæ, in which its effects could not be readily combated. In 1856 I treated, in a foreigner, an enlarged bursa at the wrist by the injection of tincture of iodine, diluted with three parts of water. Having made an incision about an inch and a half long above the annular ligament into the cyst, I squeezed out some melon-seed shaped bodies and the general fluid contents. I then injected about three drachms of the diluted tincture. The case did perfectly well; no inflammation supervened, and the cyst seemed to contract, leaving the tendons of the fingers free to move. I subsequently adopted the same method of treatment in another case, that of an Englishwoman, aged forty-two, who had been a private nurse. Although no inflammation supervened, she became hot and restless about the fourth day; then a vivid scarlet rash appeared over the face, chest, and arms, extending downwards over the trunk, and she died in a comatose state. Several physicians saw the case with me, and could not positively pronounce it a case of "scarlet fever." Whether the symptoms were in any way connected with the proceedings of the operation must yet remain a matter of doubt.

The abstraction of blood by venesection is sometimes useful in cases of acute inflammation.

Anne P., aged fifteen, an healthy but slightly-made servant-girl, pricked the thumb of the left hand on May 16th, 1840, with a needle. Shortly afterwards the part became painful, and the symptoms increased in severity until she was seen, May 23rd. The hand and forearm were red, swelled, and tender; the throbbing pain was insupportable when the limb hung down. About the thumb the integument was of bright-red colour. For three nights she had had no sleep; the tongue was furred; no appetite; twelve ounces of blood were taken by venesection. 24th.—Suppuration was detected between the thumb and the forefinger and on the dorsum of the hand. Free openings were made in both situations; the synovial theca was opened, and a considerable quantity of thick pus was evacuated. Poultice. 25th.—She feels quite easy. June 3rd.—She left the hospital in which she had been placed, quite well.

The following case is interesting. A. B., aged nine, was under my care in St. Bartholomew's Hospital, September 3rd, 1863, suffering from a swelling in the palm of the right hand of a few weeks' duration. We could not obtain any very clear history of the case, but it appeared that, a fortnight before his admission, he had been taken to a surgeon in consequence of this swelling; that the surgeon had made a puncture with a lancet, and had let out some dark-coloured fluid. The operation was followed by rapid swelling of the hand, and the protrusion of a light-grey coloured bleeding friable mass. The sensation communicated to the hand was that of fluctuation, and I made an exploratory puncture, with, however, little hope of finding matter underneath. Nothing flowed out. The protrusion rapidly increased in size, and became covered with a layer of grumous blood. Frequent hæmorrhages ensued, and the boy became blanched. Finally it was determined to amputate the limb. A delay of some hours ensued, in order that time might be given to communicate with the mother, during which the fore and upper arm suddenly became ademátous and swollen, the former being cold. The pulse fell, and symptoms of approaching gangrene supervened. Under these circumstances the limb was removed above the elbow. The boy became restless and excited, trying to get out of bed, and died eight hours after the operation.

On examining the limb we found general subcutaneous infiltration, but the arteries and veins were normal. The palm of the hand was occupied by a dark-coloured mass, through which the tendons passed unaltered. It was that structure termed a blood tumour: the microscopic appearances being those of coagulated fibrine, interspersed with granular and nucleated bodies. The smell was very fœtid. The symptoms under which the boy sank appear to have been due to blood-poisoning.

CHAPTER XIII.

TALIPES OR CLUB-FOOT.

THE term "talipes" is, after the suggestion of Dr. Little, a generic term, and includes all those deformities of the foot, which are produced by muscular contraction.

The terms equinus, calcaneus, varus, and valgus, are used to indicate the specific forms; that is to say, whether the foot is directed downwards, upwards, inwards, or outwards.

Deformities of the feet are either congenital or acquired after birth (non-congenital). Talipes calcaneus, varus, and valgus, may be either congenital or acquired. Talipes equinus is said to be never congenital, and I believe that opinion to be correct.

The causes of congenital deformities of the feet are still matters of question, and perhaps we have not yet any true solution of the difficulty. The opinion of Boyer, that congenital varus might be produced by an improper position of the fœtus in the uterus, can scarcely be maintained as applicable to the earlier periods of intra-uterine life, nor does it explain why in some cases club-foot should, to use a familiar expression, run in certain families. The opinion of Scarpa that there was some primary origin of the disturbance in the osseous system through which the insertion of some of the muscles became approximated to their origin, and that of others removed from it—the former being shortened, the latter elongated—has not received confirmation from dissection. There is no indication of muscular spasm in infantile varus; hence Jörg was in error in drawing his conclusion from witnessing the occurrence of varus from an apoplectic seizure.

Rudolphi refers the deformity to disordered influence of nerves on muscles in the fœtal state, by which their contraction is prematurely excited, and often in so vehement a manner that the mother experiences pain from the convulsive motions; the limbs thus become distorted, and permanent deformity is often thereby occasioned. Such evidence, however, as we possess, seems to point to the fact, that congenital deformities are by no means limited to the later periods of intra-uterine life, but persist from the earliest months.

Those interested in this subject should consult the masterly treatise on club-foot, by Dr. Little.*

I look upon club-foot as an instance of error of development, which is, however, by no means always equally severe in all cases, or even similar; just as I should in a case of hare-lip, or extraversio vesicæ. The dissections of Mr. William Adams, have demonstrated even in the simplest cases, some deviation in the bones, or irregularity of muscular attachment. He has particularly pointed out the abnormal direction of the articular facette of the astragalus in giving an inward direction to the foot.

We frequently find the great toe shorter than it should be; the whole foot shorter and broader than natural; the heel preternaturally small. The extensor muscles may be completely absent, and the outline of the toes wanting in sharpness.

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* 'On Club-Foot, and Analogous Distortions,' by W. J. Little, M.D., 1839.

I have known several members of the same family similarly affected; and in this year saw a lady (of whom it should be said that both she and her husband were tall and remarkably well-formed persons) who had had two babies in succession affected with congenital varus; the first was the subject of double varus, the second of varus only in one foot. The usual operations were performed and the children are now relieved.

The following history shows how the more marked malformations are continued through several generations. In the Museum of St. Bartholomew's Hospital there are a series of casts (A 21-24), illustrating the following points. The father of the man from whom the casts were taken had double thumbs and six toes on each foot. His wife had no malformation. They had eight children, of whom five were well formed; but three had supernumerary thumbs, fingers, and toes, and unnatural union of the latter. The man himself from whom the casts were taken had four sons well-formed, and two sons and two daughters with malformations more or less similar to his own and combined with club-foot.

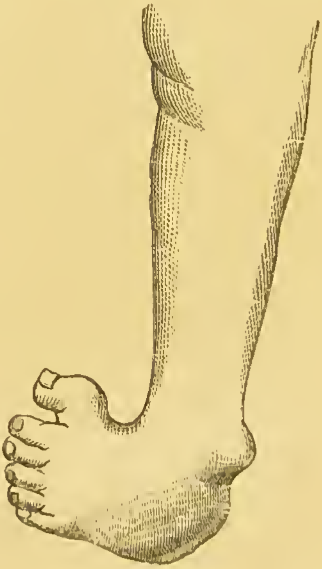
Fig. 13.—Talipes Varus with Deformity of the Limb and Six Toes.

In some instances the errors of development are so serious as to interfere with and modify our usual anticipations of giving relief.

These points must be borne in mind by the surgeon before he commits himself to the promise of a cure. He should attentively examine the foot and ascertain as far as possible its exact condition, and then endeavour to explain to the parent that the affection is one of "arrest of development;" it may be slight and remediable, but still it is a fact, requiring for proper consideration and treatment its due acknowledgment. Attempts have been made by some surgeons of late years to treat cases of deformity by the traction of apparatus alone; and without the aid of subcutaneous tenotomy. Let us remember that such methods of treatment were in some form or another known and practised long ago; and that although in course of time they yielded a result, yet that result was always unsatisfactory. The long-continued pulling at a muscle will in time make it yield; a distorted foot, confined for a length of period in a tin-shoe, will alter in form and direction. These practices were in vogue when the subject of tenotomy was taken up by Delpech and Stromeyer, and to discard tenotomy is to put aside one of the improvements of the age—a simple and almost painless proceeding, which enables us to accomplish in the space of a few weeks, that which under other circumstances might have required years. The expense of maintaining a long course of instrumental treatment is often beyond a patient's means; the pain and discomfort of wearing irons is particularly grievous to children, more especially when they reach an age when they are morbidly sensitive of differing personally from others.

In skilful hands tenotomy is free from risk, and may be performed at any age. I have operated on the fourteenth day after birth.

A tendon divided subcutaneously unites by the effusion of lymph and not by the organisation of blood. A quantity of blood is extravasated within the sheath of the tendon immediately after the operation ; this becomes absorbed and a new material is effused to unite the divided ends. The blood vessels of the sheath become unusually large and tortuous, and continue so until the process of repair is effected. But this new material never acquires the colour and all the characteristics of the original tissue. The repaired tendon may appear externally the same ; but its longitudinal section shows the exact line between the old and recent tissues. Should the divided tendon thus examined present no trace of new tissue, then we must presume that the divided ends have been brought together by contraction into linear apposition. The new material may become elongated and very thin, as seen in a specimen presented to the hospital by Mr. W. Adams. "Parts of the tibialis posticus and flexor longus digitorum of a child in whom the tendons of these muscles were divided a short time before death. The ends of the divided tendons, retracted about two lines asunder, are united by a slender bond of new formed substance." (Ser. V., No. 25). In the event of the extension being carried on more slowly, the connecting material is thicker and firm, as in the particulars of a case reported by me in the 'Medical Times and Gazette.'

An undersized man, aged thirty-eight, suffering from lateral curvature of the spine and talipes equinus of both lower extremities, a cripple, unable to put his foot to the ground, was admitted in the month of August, 1857, into the Royal Orthopœdic Hospital. The right tendo Achillis was divided August 27th, the left September 30th. A "Scarpa's shoe" was applied on either foot, and the heels were well brought down by the end of November. On the 23rd of November, the influenza being then prevalent, the patient was seized with cough and cold. Pneumonia of both lungs rapidly supervened; he lay restlessly on the right side until the 26th, when he rapidly sank and expired about six in the afternoon. The tendons had been divided by Mr. Tamplin. The examination of the body was conducted by Mr. Pocklington, who found general consolidation of the right lung, and a great amount of secretion in the bronchi and pulmonary tubes of the left. With these *post mortem* appearances, however, I do not interfere. The divided tendons, with the newly formed connecting tissues, were removed and consigned to my care for examination. I was particularly interested in the investigation, inasmuch as no instance was on record of the examination of such parts as seen in the adult two or three months after operation.

The right tendo Achillis was adherent to its sheath. It presented the usual pearly white colour. The surrounding vessels, especially the veins, were full and tortuous. The external fibrous investment was complete and of usual appearance; but between the two extremities of the tendon there was a compressed portion *two inches in length*, the transverse measure of which, as compared to the obviously normal part, was as two-eighths to three-eighths of an inch. A longitudinal incision through the tendon showed an interval of just two inches between the divided ends of the normal tendo Achillis, which were united by a light-grey semi-transparent structure, through which were traced well-formed, opaque, pearly-white fibres, passing from one extremity to the other of the cut tendon. The new tissue was clearly defined from the old, being of a totally different colour, the opaque white hue of the normal structure standing out in strongly marked relief. After drying for a short time, the new tissue acquired a rosy tint, obviously due to the blood contained in numerous capillaries.

The interval between the cut extremities of the left tendon did not exceed *one inch and a half*. The transverse measurement was the same as in the preceding specimen; but along the sheath there were numerous patches of extravasated blood.

The opaque white fibres of the original tendon were separated in parts at their junction with the newly formed tissue, which appeared in the interspaces, and were dovetailed. Towards the lower part of the connecting medium, near its junction with the calcanéal portion of the tendo Achillis, there was an oval cyst, half an inch in length, containing dark fluid blood.

The examination of the newly formed tissue under the microscope exhibited some points of interest. It contained a large proportion of oil-globules intimately mingled with the firmer and more fibrous material. The latter consisted of granular matter, and of newly formed fibres of ill-defined contour; yet exhibiting in many situations the appearance of being formed of elongated nuclei, for at the broken edge of the specimen numerous loose nuclei were seen floating about free, or united in linear series of three or more. There were some whiter and more opaque parts among the newly formed tissues; these closely resembled, but did not quite equal in clearness and in contour, the normal white fibrous tissue of histologists.

A series of specimens beautifully illustrating the effects of the subcutaneous division of tendons, and the subsequent process of repair, has been recently presented to the Museum of St. Bartholomew's Hospital by Mr. Vernon, one of the Demonstrators of Anatomy.

When a tendon has been divided, the wound must be closed by a small pledget of lint and a piece of strapping; the foot and leg must be first carefully and warmly rolled, and then attached by the turn of the roller to a firm yet flexible splint, which will keep the limb easily extended in such a position as to allow of the approximation of the ends of the divided tendon. If the limb is cold it must be covered with flannel or with cotton wool. The patient must be kept in the horizontal position; and is generally better in bed. He should have his usual diet and take no purgative medicine, which will disturb him and possibly retard union. In the case of an infant on whom I once operated, the mother retarded the process of repair for fourteen days by the administration of drastic purgatives, in order to "prevent inflammation!"

Let us also remember that there are cases in which the tendon sloughs, when abscesses form up the course of the leg. They are, however, quite exceptional.

Extension may be commenced on the fourth day in the infant, and on the sixth day in the adult, after operation. But the uniting structure is thrown out and organised much earlier. My colleague, Mr. Paget, who terms this uniting substance "nucleated blastema," found that in rabbits forty-eight hours usually elapse before there are distinct signs of the production of the proper reparative material, and that this is deposited in the fibro-cellular tissue that lies between and close round the separated ends of the tendon, as well as in the interspaces of the tendinous fasciculi of those ends.* Of the strength which the new material acquires, we may judge by the fact, that Mr. Paget proved by some experiments (Op. cit. p. 273) that the Achilles tendon of a rabbit, divided six days previously, would bear a weight, without yielding, of about twenty lbs. And in another experiment, the bond of connection after ten days' interval, bore weight up to fifty-six lbs., when it was torn and yielded.

The process of extension in the human subject must be slow. If the new material is acted on too quickly it may become thin and weak, or give give way and unite to the sheath: moreover, it is then very apt to recontract, when the apparatus is removed.

This woodcut represents the so-called "Scarpa's shoe," now in general use. All the pieces of steel are firm and unyielding, and extension is made by means of cog-

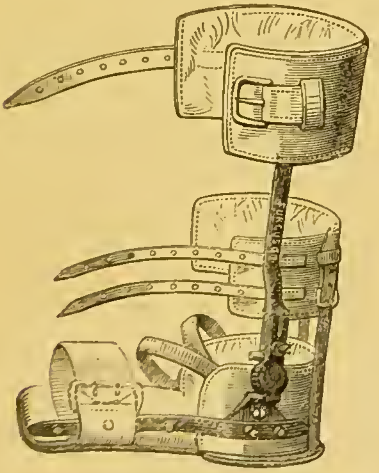

Fig. 14.—Scarpa's Shoe.

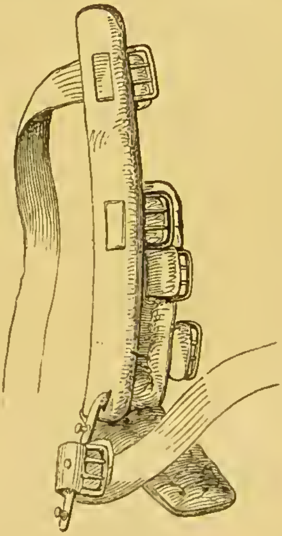

Fig. 15.—Varus Splint.

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* 'Lectures on Pathological Anatomy,' p. 268.

wheels and screws. It is inferred that the amount of extension is more regular and more easily graduated than when springs are employed. The outward inclination of the foot is effected by the webbing strap, which passes between the sole of the foot and the foot-board.

In the case of infants we use the lighter apparatus termed the varus splint.

When the position of the foot is rectified, a boot with double irons and a strap may be necessary for the space of some months.

Talipes Equinus.—Talipes equinus consists in the elevation of the heel, the increase of the arch of the foot; in the "spreading" of the metatarsal bones, so that the foot is broader than natural. The patient walks on the toes so as to resemble in that respect the mode of progression of a digitigrade animal, such as the dog rather than the horse. The disease of the muscle is progressive and may drag the foot into such a position that the dorsum rests on the ground. This is the simplest of the deformities of the foot, and should be rectified in early life. For when this abnormal condition has become confirmed, the articular facettes of the tarsal bones undergo change; parts naturally distinct become adherent; and the treatment after operation would be both painful and prolonged. On the other hand, a patient walking on his toes with the heel raised is wonderfully apt to sprain and to wrench the ankle on the least accident. Most severe pain ensues, obliging him to lie up for a fortnight or three weeks, or longer. The subcutaneous division of the tendo Achillis is necessary to free the foot; the cut ends must be reunited, and the soft material stretched to a sufficient extent. The patient should then wear for many months a boot with double irons and a stop joint at the ankle to prevent the heel being dragged up again by contraction.

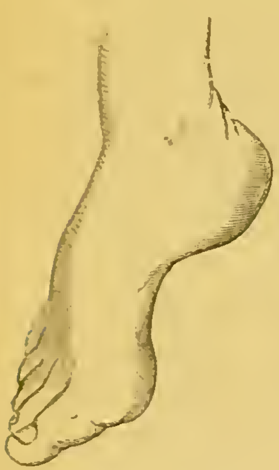

Fig. 16.—Talipes Equinus.

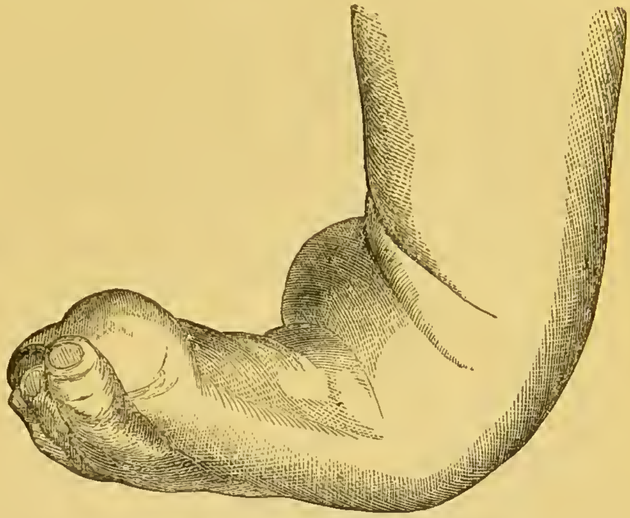

Fig. 17.—Talipes Equino-varus.

Simple talipes equinus is now well understood, but the following variety is less so. The foot is contracted at a right angle to the leg. The deformity is slight, but the inconvenience is very considerable—and patients will demand the necessary relief. For instance, the patient cannot raise the foot beyond the right angle in progression. The consequence is that he presses the fore part unduly against the ground and becomes troubled with a "corn" on the sole.

A lady, the subject of this complaint, can enjoy a dance, with the feet extended for many hours. But she feels much pain in standing for any time—the arch of the foot slowly yields; and the yielding of the calcaneo-scaphoid ligament is attended by almost unbearable pain.

No one thus circumstanced can go *down* stairs quickly; he may easily run upstairs, but the converse implies the power of raising the foot towards the front of the leg, a position which the "rectangular contraction" renders impossible.

The act of standing for some time, as at church service, becomes irksome and painful, and patients shift the weight of the body from one foot to the other, or sit down. They dislike taking long walks, and fear fatigue. A lady, remarkable for both bodily and mental activity, and very desirous of accompanying her husband on his travels, consulted me in consequence of feeling quite unable to walk any distance; even across a road to look at a remarkable view. I found this condition of the foot in an early stage, and was enabled to rectify it by rest, the use of the Scarpa's shoe, and of proper walking boots, by which there was ample space given to the sole of the foot, and the arch was slightly supported.

I have seen many cases of rectangular contraction of the foot. A tall and fashionable young lady consulted me for this condition, which manifested itself only by pain in the foot when she was standing or walking. She could dance without discomfort, but then the toes were pointed downwards. In walking down stairs she felt an inclination to fall, owing to the inability to raise the foot, but she could run upstairs easily enough. Now in this case the symptoms were not sufficiently severe to warrant the recommendation of the division of the tendo Achillis; she was "sometimes better, sometimes worse," according to the condition of her general health and the state of the catamenia. I therefore recommended steel medicines, sea air, horse exercise, and the daily employment during hours of repose of a Scarpa's shoe to stretch as far as possible the muscle of the calf, and I have reason to believe that in the course of a few months, this treatment was found sufficient.

But talipes equinus may be the result of accident.

Case I. I was requested on November 10, 1857, to examine the right foot of a gentleman, who five weeks previously had fractured the fibula by a fall. He had been under proper treatment, and the broken bone was firmly united; but he was unable to bring the heel to the ground. The foot was movable as far as the tendo Achillis would allow, and there was no great amount of thickening of the soft parts; but the patient was unable to walk, save a few steps at a time with the aid of a stick or crutch, the toes just touching the ground. Now, others had seen this case, and it was surmised that there had been a fracture of the tibia, extending into the joint; but careful examination showed that the change consisted solely in an increasing contraction of the muscles of the calf and of the peronei, by which the foot was thrown into that position called talipes equino-valgus, namely, pointing of the toe downwards, with slight eversion of the foot. The application of a Scarpa's shoe enabled me, without division of tendons, to bring the parts to their proper bearing; and early in December this gentleman was able to put the foot well on the ground and walk about with comparative ease. Not having lately heard from him, I have reason to believe he continues well.

It does not follow that time will rectify this state of things. On March 29th, I assisted Mr. Tamplin in an operation on the foot of a lady, who two years and a half previously had fractured both bones of the left leg. Perfect union had taken place, but she had never from that time been able to bring the heel to the ground, and had in consequence been entirely precluded from taking exercise. The loss was to her the more serious, as she was a person of remarkably active habits. No relief had been afforded by any course of treatment hitherto recommended. In this case the tendo Achillis was divided, and the foot rapidly came into position.

Some of these cases come under the head of partial dislocation of the foot backwards, combined with fracture of the bones of the leg; and they have been recognised by Dupuytren, who recommended the application of an instrument in some respects resembling that now in use for such an accident. The true position of the bones was illustrated by a case which happened many years ago in St. Bartholomew's Hospital, of which the following are the particulars. A middle-aged woman was admitted in 1837 under Mr. Lawrence into Faith Ward, with fracture and great swelling of the leg, following a fall. There was detected, upon examination, partial dislocation of the tibia forwards, with fracture of the fibula. Proper means were adopted to subdue the swelling, and then an effort was made to bring the bones to their proper relations; but they were found to be immovable. Subsequently an attack of erysipelas supervened, and the patient died. There was found, on the dissection of the limb, fracture of the fibula, about three inches from the lower extremity; fracture of the inner malleolus, and dislocation of the foot backwards, so that the articular extremity of the tibia rested upon the front of the astragalus and on the os naviculare.

In more severe cases, I have seen the tibia resting upon the os naviculare and the internal cuneiform bones.

Talipes equinus ensues from disease. There is such a case at the present time in St. Bartholomew's Hospital.

Case II. Elizabeth R., aged twenty, a healthy young woman, was in St. Bartholomew's Hospital last September with phlegmonous erysipelas of the right foot. After the disease had subsided, it was found that the tendo Achillis had become so contracted that the foot and toes were kept in permanent extension. After an interval of three months, she made up her mind, the limb being useless, to have that done which from the first was necessary—namely, the subcutaneous division of the tendo Achillis, an operation which I performed in January. The foot is now flat upon the ground, and the surrounding swelling has in very great measure subsided. This case is now going on favourably.

The most striking cases of this deformity commence in infancy, when, from some unknown cause, the muscles which oppose the great muscles of the calf become partially or completely paralysed. The changes which ensue in the limb are remarkable, as will be seen by the following notices of preparations; and it must be remembered that whenever there is loss of nervous power, the nutrition is impaired, the muscles waste, and, in the event of the patient arriving to maturity, a remarkable difference in the length of the two limbs ensues.

The Museum of St. Bartholomew's Hospital contains a specimen of talipes equinus (Ser. I. A., Prep. 151), presented by Mr. Wormald, of which the following history may be surmised. The patient must have suffered in early life from infantile paralysis. The muscles which extend the right leg and raise the foot lost their power. Then the flexor muscle raised the heel and kept the toes pointed towards the ground. "All the bones of the right lower extremities are atrophied: the prominences on the right os innominatum are less marked, and the iliac fossa is more shallow than the corresponding parts on the left side. The bones of the right thigh and leg are all shorter, less in circumference, softer and lighter, than those of the left limb. From the hip-joint to the ankle there is a difference of nearly two inches in the length of the limb." All the tarsal bones are slender, small, and soft. The left foot is directed vertically, the arch of the sole increased by a projection of the posterior part of the os calcis. The weight of the body is transmitted to the front part of the foot by the astragalo-scaphoid and calcaneo-cuboid articulation. The ground was touched by the distal extremities of the metatarsal bones; the phalangi have acquired for themselves new articulating surfaces on that which, in the usual position of the foot, would have been called their dorsal aspect, here rendered anterior.

Dittel (l. c. Jahrg 7, Heft. 6, S. 440), in describing the dissection of a case of pes equinus, observes: new articulating surfaces were found, 1. On the posterior border of the articulating surface of the tibia (partly convex and covered with a fibro-cartilaginous layer), articulating with the posterior border of the upper articulating surface of the os calcis. 2. A similar one at the posterior border of the malleolus externus, also articulating with the os calcis. 3. A similar one on the posterior part of the body of the astragalus. 4. On the upper surface of the distal extremities of all the metatarsal bones. The proper fibrous capsule was continued over both the normal and the additional articulating surface, being more capacious than natural. Two-thirds of the articulating surface of the head of the astragalus were exposed, denuded of cartilage, and covered with a fine fibrous membrane.

Chassaignac ('Archiv. Gén. de Méd,.' le série iv., 1834, p. 220) laid before the Anatomical Society of Paris a preparation of what he presumed to be an incomplete luxation of the astragalus; but it was more probably a specimen of pes equinus, as Gurlt remarks in his work on the 'Joints.' The whole lower extremity was short through atrophy of the femur (?). The astragalus corresponded with the tibia by the posterior half of its articulating surface; the whole anterior part, which was covered by a very resistant fibrous tissue, exhibited some remains of articular cartilage. The shallow fossa behind the articulating surface of the astragalus corresponded with the articular extremity of the tibia; on the other side, the head of the astragalus in its articulation with the os scaphoides was incompletely dislocated in its anterior part. Moreover, this head was covered anteriorly by a newly formed process, which projected over the dorsum of the foot. It was remarkable that, through this half-dislocation, the os calcis and the lower extremity of the tibia came into contact in two situations: 1. Posteriorly by means of a newly formed articulating surface, which was quite distinct from the astragaloid surface of the os calcis and lay behind it; 2. Externally by means of the external surface of the os calcis and the most prominent part of the external malleolus. There was here no distinct articulating surface.

"Talipes equinus" is not congenital. The causes of the non-congenital deformity are numerous. The irritation of teething, worms, any derangement of the nervous system, wounds in the calf, rheumatism, scrofulous disease in the ankle-joint, or in the substance or tendon of the gastrocnemius muscle. Not unfrequently, however, this deformity arises spontaneously.

The treatment consists in the division of the tendo Achillis, and of its subsequent elongation to the proper length.

In some of the slighter cases simple extension with a Scarpa's shoe will suffice.

The following dissection of an old case of talipes equino-varus may be interesting. There was fatty degeneration of the muscular fibres of the peroneus tertius; the plantar fascia was very strong and dense, and thickened by the addition of transverse fibres; that part covering the muscles of the little toe was very strong. The inner border of the foot was concave; the muscles were pale and atrophied. The integument of the dorsum pedis was converted into a thick pad where it came to the ground; underneath it was a large bursa. The tendinous theca was greatly thickened by the addition of fibrous bands. The muscular fibres of the tibialis anticus were absorbed, so that the tendons appeared of great length; it was inserted into the interior annular ligament and the internal cuneiform bone. The extensor communis digitorum and peroneus tertius were united by strong fibrous bands; the tendon of the latter was very strong. The tendon of the extensor proprius pollicis was tightly bound down in its sheath. The sole of the foot was turned upwards and inwards by the following muscles: tibialis anticus, extensor proprius pollicis, abductor pollicis, tibialis posticus, flexor communis digitorum, flexor longus pollicis. The weight of the body rested on the astragalus, os cuboides, outer and middle cuneiform bones, and, in some degree, the metatarsus and tarsal extremity of the os calcis.

Talipes Calcaneus appears in both the congenital and non-congenital form. Of all the deformities supposed to proceed from intra-uterine pressure, this is most strongly supported by both the condition of the member and the subsequent progress of the case. The muscles are natural in development; the foot is perfect, except that it is "flat;" and in the course of a few weeks after birth it comes down, without assistance, into its natural position. There is rarely, if ever, need for the division of the extensor tendons; the mother may rub the foot and exert gentle traction, and I have not met with any case which resisted such simple measures.

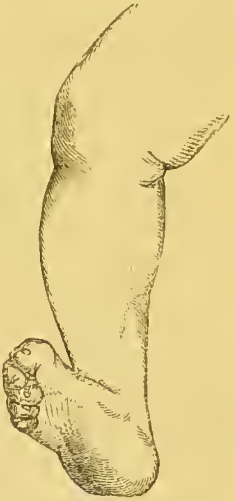

Fig. 18.—Talipes Calcaneus.

Non-congenital talipes calcaneus may proceed from an attack of infantile paralysis, by which, contrary to the usual course, the muscles of the calf and the flexors of the toes become paralysed and weak by fatty degeneration. The surgeon must be careful in his tenotomy in these cases. The foot is cold; the ligaments are very weak; the patient needs all the support he can acquire. The surgeon must limit his endeavours to putting the foot flat, so that the patient may walk with the sole on the ground, and supplying him with a boot with double irons, the hinge at the ankle having a catch to prevent the foot being *raised* beyond a right angle; necessary straps pull the ankle inwards or outwards, as may be required. In this form of disease the leg does not grow equally with the opposite.

But talipes calcaneus may follow the operation of division of the tendo Achillis for the cure of talipes equinus, provided the extension be too rapid, or the patient be allowed to use the foot too soon. In a paralytic case, the foot should not be allowed to touch the ground after operation for at least six weeks, lest the new material should stretch and produce such a deformity as that here represented, which is unfortunately irremediable.

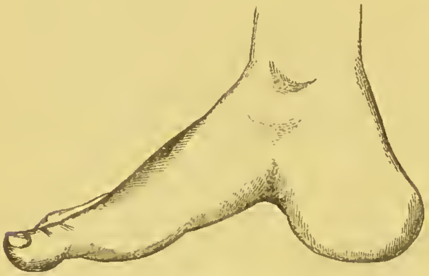
Fig. 19.

Many growing girls suffer from weak ankles; the arch of the foot is perfect, but the inner malleolus projects, and the foot has an inclination for eversion. The only cause for anxiety proceeds from the fact that the deformity may increase and lead to spurious pes valgus and to an unsightly foot. A boot with an outside iron, and free movement both in flexion and extension at the ankle, with a leather strap to pull the ankle outwards, worn for a few months, will put the case right. There is no necessity for any operation, nor division of tendons.

Talipes Varus, or club-foot, properly so called, depends on the morbid state of tension of the tendons of the three muscles: tibialis posticus, tibialis anticus, and tendo Achillis. It may be slight, or very severe; single, *i. e.* attacking one foot; or double, *i. e.* both feet. It is often congenital, but may proceed from a variety of causes acting after birth, when the term of "equino-varus" is used. The position of the feet is shown in the annexed woodcut.

The most important tendon in the production of this deformity is that of the tibialis posticus, and I do not believe that a cure can be effected unless it be fairly divided, and that is not always an easy task. In the infant it is a mere riband, and lies close on the bone: indeed, its sheath is often mistaken for the bone itself. The posterior tibial artery lies in dangerous proximity, and has been wounded even by the most experienced hands.

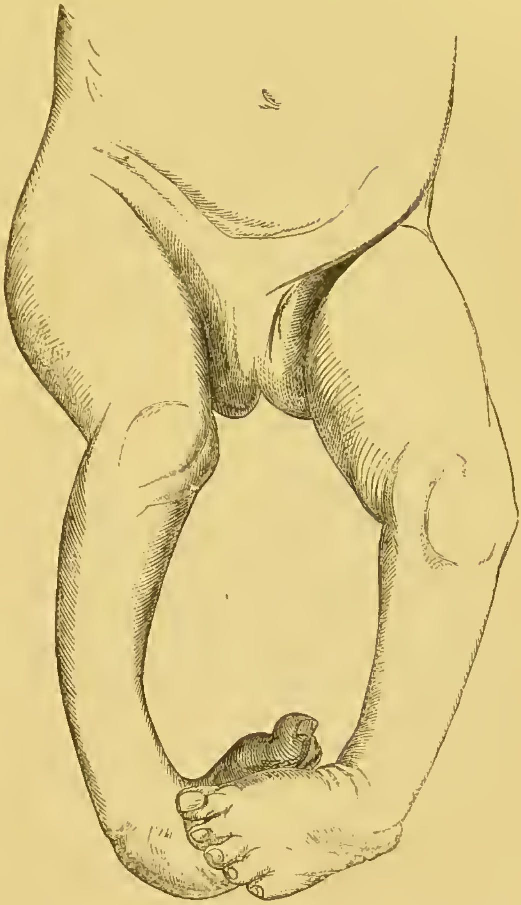

Fig. 20.

In infants the operation may be performed fourteen days after birth; but the usual time is one month or six weeks, and not later. The surgeon wishes to avoid that time when the child is subject to the irritation of dentition. At a later period the parts are more fixed in their unnatural position, and the little patient is of an age to give infinitely more trouble.

In the division of these three tendons we employ a small scalpel to open the sheath of the tendon of the tibialis posticus, and a round pointed knife to divide the tendon without wounding the posterior tibial artery. The tendon lies *close to the bone;* so close, indeed, that in a fat limb it may be readily missed, even by a careful operator. When it has been divided the surgeon feels the snap, and there is an immediate marked difference in the mobility of the foot. This constitutes the most important step in the operation, for without it all subsequent mechanical treatment is unsatisfactory. It was, I confess, with feelings of great surprise that I heard from a distinguished German surgeon that in his country the posterior tibial tendon was never divided. The success attending the cases to which this gentleman referred was most probably due to the fact that he operated upon feet affected with talipes equinus or equino-varus, in which the tibial tendons had no primary action on the deformity.

The rule must be rigidly enforced that the child should be properly fed, should take no medicine except what the surgeon orders, and that the foot should not be touched. These rules are not unnecessary. A lady brought her infant, the subject of congenital talipes varus, to me, in 1860. I operated, and, after giving proper directions, bound up the foot on a bent splint. I saw the child daily, but was annoyed at finding the wounds did not heal in the usual time. On inquiry, I made out that, according to ancient custom, she had put the child on low diet, and given it a dose of calomel and jalap every other morning. On stopping this treatment the mother saw that the wound closed without trouble. In August, 1865, I operated on another infant. The mother, who was poor, made a wretched nurse. After the operation the wound over the tendon of the tibialis posticus would not heal, and I found that she entertained an idea that she could shorten the treatment by pulling the inverted foot outwards two or three times a day by force. This was corrected, and the case was so near a cure that she returned to her home in the country. When there she resumed, I presume, her former violence; for a slough formed at the seat of operation, and the child lost much blood from the posterior tibial artery, which had ulcerated. She again came under supervision, when pressure stopped the flow of blood, the wound healed, and the child recovered.

A wound of the posterior tibial artery, once seen, cannot be mistaken. A jet of bright blood shoots forth, which common pressure does not suffice to stop; the foot becomes completely blanched, as the foot of a dead person. This condition never occurs in a wound of any other vessel, such as a large vein. In the infant the treatment consists in the complete division of the vessel, so as to allow it to contract; in the application of a firm pad; and in the envelopment of the whole foot in cotton-wool. In the patient of twelve years and upwards, the artery must be tied at both ends—a troublesome proceeding, and one which greatly retards the restoration of the foot. Mr. Lawrence operated, October 10th, 1846, on a boy aged eleven, for talipes varus. He divided the tibialis anticus, tibialis posticus, and the flexor communis digitorum tendons. After three days frequent hæmorrhages ensued, which were arrested by pressure; but a slough soon formed, and it became necessary to divide the artery and tie the two ends, on October 15th. Suppuration took place in the sole of the foot and behind the malleolus, and portions of the tendons of the tibialis posticus, flexor communis digitorum, and flexor longus pollicis sloughed and came away.

The situation of the posterior tibial artery is subject to great variety: sometimes it is a short distance from the tendon of the flexor communis; sometimes it is immediately behind or even under it. Hence we should always use a rounded knife at the tip.

The whole limb is often inverted after the foot has been put right. This deformity may be rectified by the patient wearing for many months an apparatus consisting of outside irons, attached to the boots with a strap and buckle, to be tightened at pleasure behind the waist. By means of tightening the strap the toes can be turned outwards, and in course of time the patient becomes accustomed to walk like other persons.

In all these cases it must be remembered that there is positive deformity; not mere faulty position. A superficial observer might look upon the case as one of simple displacement from "intra-uterine pressure;" and this view may be more popular with the public. But the truth is indisputable, that in every case there is more or less arrest of development, and the more severe the case the earlier is the "fault" in the period of utero-gestation and the greater the consequent deformity. It is affirmed that these cases are not hereditary; nor, indeed, are the milder ones so; but I have seen cases of congenital varus twice and thrice in the same family, and in the greater number of instances the two limbs were not alike, though symmetrical in point of length.

In some specimens the deformity is more strongly marked than in others: the foot being shorter than natural, and the os calcis small; a large bursa forms on the outer side of the foot, the calf is thin, the muscles atrophied and fatty. In such a case the surgeon must be cautious in his promises of relief. He has to deal with a most troublesome and anxious case. It is true that he may succeed in putting the foot straight, but this can only be accomplished after many months of treatment, and the irons must be worn to prevent relapse. Should the tendons of the extensor muscles of the toes be absent, which is known by the want of voluntary movement of the toes and by their want of outline, the case is more than commonly troublesome. The surgeon, by means of operation on the flexor and posterior tibial tendons, and by prolonged extension may put the foot into proper position; but as soon as the irons are removed, the member, from want of any opposing power, is dragged back to its abnormal position, and this will recur after many years of constant supervision. It once happened to me to amputate a leg thus afflicted. The patient was a young woman and a dressmaker. She had availed herself of all the resources of orthopœdic surgery. Her tendons had been cut, reunited, and subsequently elongated. The feet were well placed, the soles on the ground, and yet a few weeks' removal from medical supervision sufficed to bring back her trouble. Being unable to gain a livelihood, she applied to me that I might amputate the limb. The operation was performed in the usual way. I made a proper flap of flabby and cold skin and pale fatty muscles; I then sawed through bones composed of a shell of earthy matter surrounding a mass of fat. Scarce an artery had to be tied. The patient recovered without a bad symptom, and left the hospital supplied with an artificial limb on which she could walk with comfort. In this case the inversion of the foot was so great that even the "peroneus longus" contributed to its displacement.

When a patient, the subject of talipes varus, has walked for many years on the outer side or on the dorsum of the foot, a large wad of thick integument forms on the most depending part, and the metatarsal bones become folded up together, producing a deep furrow in the sole of the foot.

The wad of thickened integument may slough away, in which case there ensues an open wound, just on the spot where the foot touches the ground, and the patient in such a condition is confined to bed. After the operation of the division of tendons, and in the course of a few weeks, the patient being kept at rest, this thick wad disappears entirely without treatment. I have never met with any exception to this, and the fact may be of value in reference to the treatment of thickened bursæ over the patella.

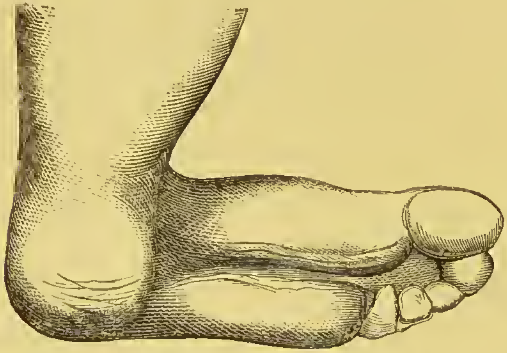

Fig. 21.—Talipes Varus, Compressed Foot.

When the metatarsal bones are folded up, *they must be unfolded* as much as possible after the division of the tibial tendons, by means of a pad and screw, before the final division of the tendo Achillis. It matters not how many months are passed in this act. Unless it be done thoroughly and well, the after part of the treatment is comparatively useless.

One may in general readily distinguish between congenital and non-congenital varus. In the former, the parts are rigid and firm; in the latter the rigidity is comparatively moderate; and in cases where there is paralysis there is also atrophy and diminished warmth; consequently, in non-congenital varus the outline of the limb is less pronounced, the general aspect is more withered, the temperature is affected by external causes, and the patient suffers from chilblains. The ligaments of the ankle-joint are much weakened, and the foot readily acquires any position in which it is habitually pressed. Patients bear upon the foot with difficulty; the pad of skin on the outer side of the foot seems particularly sensitive and prone to inflame. But in talipes varus of both varieties the heel is raised; the scaphoid, cuboid, and cuneiform bones, with the metatarsus, are drawn upwards and inwards, often to such an extent that the scaphoid bone comes into contact with the inner malleolus. The head of the astragalus is unduly prominent; the upper surface of the os cuboides is somewhat separated from the os calcis; the tendons of the tibialis anticus, extensor proprius pollicis, and extensor longus digitorum pursue an inward course, so as to add by their action to the deformity. The tendons of the tibialis posticus and the flexor longus digitorum are likewise tight and unyielding. The mode of treatment is the same.

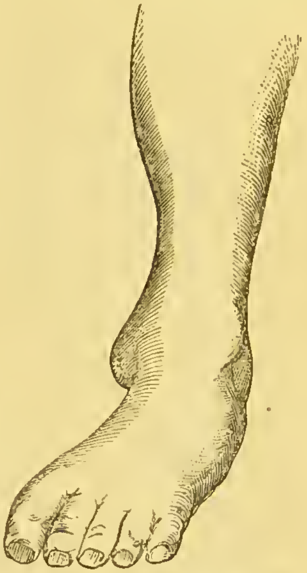
Fig. 22.—Talipes Varus, with Inverted Foot.

Talipes Valgus, or flat-foot, proceeds from the yielding of the calcaneo-scaphoid ligament and the sinking of the head of the astragalus, so that it projects inwards and sinks down towards the ground. The foot is elongated and splayed; the patient suffers severe pain, which is often mistaken for the effect of gout or rheumatism. This pain may be seated in the arch of the foot, or transversely across the dorsum, or run along the course of the peronei muscles. Patients, the subjects of this deformity, usually wear the trousers wide over the foot, in the idea that by such means the increased size of the foot is less remarkable; but the gait can always be recognised. The labour and fatigue of walking is infinitely aggravated. In former times, when the treadmill was a common punishment for slight offences, a prisoner the subject of talipes valgus was unable to keep pace with the others: the pain in his feet became insupportable. Likewise recruits, in whom this condition of the feet is pronounced, are rejected as unfit to perform the duties of a long march. We meet with bad cases now among bakers, shopmen, girls employed in show-rooms, indeed, in all those who are many hours daily on their feet. The treatment consists in the employment of a well-made boot, broad in the sole, with a pad of elastic introduced to raise the astragalus and restore the arch of the foot. In some cases this measure affords immediate relief. In other cases the subcutaneous division of the peronei tendons is necessary. A flat splint, with a pad, may be used for several weeks to assist in pressing the astragalus upwards, and a Scarpa's shoe with reversed action may be required at night. The muscles of the leg are, in some instances, in such a state of irritability that all the tendons about the ankle seem tense and rigid. If we

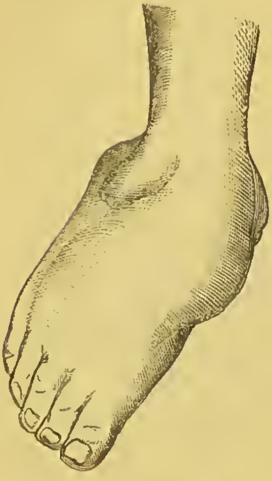

Fig. 23.—Talipes Valgus.

confine the patient strictly to bed for a week, most of the muscles become quiet, and those only retain their spasm which are concerned in the production of the deformity. We thus learn which tendons we may have to divide, and which we may leave intact.

The pad under the arch of the foot must not be too large, lest by its pressure it throw over the body to the opposite side. When the ankle falls inwards, a boot with outside iron and strap is necessary for many months afterwards.

I have met with cases in which severe joint-disease has been confined to the calcaneo-scaphoid articulation. In all such cases the patient has been the subject of flat-foot. The cause of the disease may have been either continued exertion by the patient, or an injudicious attempt to raise the arch of the foot by the surgeon. Should the latter insert under the calcaneo-scaphoid articulation a pad which exerts too much pressure, disease may be excited, which will terminate in the destruction of the articular cavity, and possibly be followed by necrosis of the bone. I have under my care a patient, whose employment is that of hair-dressing. In his feet the arch has sunk, and the peronei muscles have pulled outwards and everted the sole. The inward displacement of the bones of the leg has subjected the inner ankle to undue pressure, and chronic ulcers have formed in consequence. He has been the subject of this calamity for seven years, and yet, wherever he has been, the treatment has been confined to the healing of the ulcers; the malposition of the foot has not been recognised, or, if so, has been considered unimportant. I have first healed the ulcers; next divided the peronei tendons; thirdly, raised the arch of the foot by proper pressure; and finally discharged him again able to work for his living.

In many cases of talipes valgus the tendo Achillis is so tight that the foot cannot be raised beyond the right-angle to the leg. In such patients a cure cannot be effected without the operation of tenotomy. The elongation of the tendon by proper treatment enables the surgeon to introduce with proper effect the pad under the arch of the foot. In the event of there being any doubt as to which of the tendons are in a state of permanent contraction, the patient, as already mentioned, had better be kept in bed for a week, when those which are only spasmodically tight become relaxed, and resume their normal state.

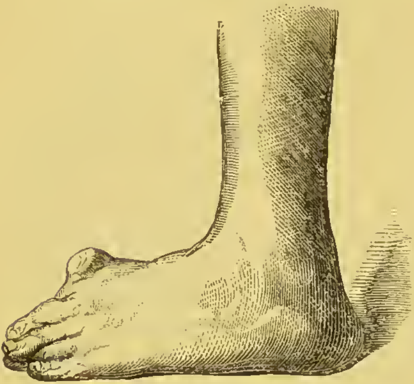

Fig. 24.—Rectangular Talipes Valgus.

Talipes valgus may be a congenital affection. I saw the case of an infant, five years old, with flat foot, combined with some degree of inversion, as in talipes varus. On examination, the true nature of the case was seen, namely, congenital valgus; the inversion of the foot being an almost involuntary act for the relief of the sunken arch and the pain excited in the sole of the foot in progression. In congenital cases, even of the slightest kind, it is almost invariably necessary to divide the peronei tendons.

CHAPTER XIV.

ON RICKETS.

Rickets is a disease peculiar to infancy or childhood. We have in the Hospital Museum many specimens illustrating its effects. For instance, a section of the femur of a ricketty child cut with the knife. It is curved in consequence of want of its natural hardness. The shaft, instead of the usual division into solid walls, and the medullary cavity, consists throughout of cartilaginous and gelatinous substances intermixed and disposed in cells. It is observable that a greater quantity of the cartilaginous substance exists in the middle of the shaft, and towards the interior curve, than at any other part. The articular ends of the bone are in a natural state.

In another specimen (No. 36) we have fragments of the upper part of a skull, increased from half an inch to three-quarters of an inch in thickness, and consisting throughout of a very finely porous or spongy substance, which is dry, hard, and heavy, but friable and crumbling under the fingers like hardened mortar. Into this substance both all the diploë and the tables of the skull are changed. In the inner table scarcely any trace, and in the outer no trace, of compact substance remains.

It is affirmed by Whistler ('Dissert. Inaug. de Morbo Puerili, dicto "The Rickets,"' 1645), and on his authority afterwards by Glisson, Bate, and Ragemorter, that the disease first made its appearance in England (in the Western Counties) about the middle of the seventeenth century; thus Continental writers termed it, Morbus Anglicanus, Maladie Anglaise, Englische Krankheit. Such an assertion is evidently at variance with probabilities, and with the accounts given by ancient writers of short and mis-shapen men.

It is not confined to the human race, having been seen in the monkey (Lordat), ox (Bicherod), horse (Dupuy), lion (Mason Good), sheep (Comber), and in whole broods of young geese and ducks, when they have been continually exposed to cold and wet. Also in young pointers and greyhound puppies when confined in cold and damp kennels, and in pigs. The causes are cold, moisture, and bad nourishment; and for its cure, baths of hot grains are used, oily frictions, nutritious food, and removal to a warm and dry place.

Rickets is often a congenital affection, but rarely develops itself until about the seventh month or at the period of dentition. The child about to be so affected becomes dull and languid, the appetite is variable and capricious, the bowels irregular, the motions unhealthy, and often pale. There is general febrile disturbance, the skin being hot, the breath offensive, the sleep often broken by startings and irregular movements.

The healthy nutrition of the body is impaired; no food seems properly assimilated, the limbs become emaciated, the belly tumid, the face full, heavy, and inanimate, the head large, the cranial sutures remaining open, or perhaps expanding slightly. The extremities of the long bones of the wrists and ankles, and the sternal ends of the ribs, become swelled and knobbed; the spine yields and becomes the seat of lateral curvature, generally double; the ribs are flattened, the sternum projecting like the keel of a boat. The lower extremities bend under the weight of the body; the thighs bend forwards and outwards; the knees turn inwards; the bones of the leg forwards and outwards; or, as is more rarely the case, the limbs become generally bowed. Now in this affection the pelvis is deformed, the pubes approaching the sacrum so that the cavity is diminished, and in the female this change entails dangerous consequences at the period of parturition. In the upper extremities the deformity is less, and commonly is determined by muscular action. The bones of the hands and feet are less liable to undergo change than the long bones. But the vertex of the head is usually flattened, the parietal bones flattened, the forehead prominent, the visage shortened, the lower jaw elongated; the process of dentition is protracted, the teeth soon decay, the enamel of the permanent teeth is often craggy and worm-eaten, the fang, according to Mr. Wilson, has been found softened.*

Brunninghäuser observed all the bones soften in the space of six weeks. In the advanced stages fractures readily occur, the abdomen becomes more tumid, the urine is rarely healthy, sometimes clear, at other times with a copious white sediment. At length the patient becomes hectic, and suffers from diarrhœa and perspirations. The intellect may be preternaturally quick, but more commonly children are silent and taciturn, often stupid. Many perish; but others, more favourably circumstanced, "grow out of it." They may be much deformed, it is true, but they afterwards become active and strong. During convalescence they often show a partiality for particular kinds of food, such as common salt, which they will consume in large quantities.

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* 'Cyclop. Med.,' art. *Rickets.*

The softened bones again become hard by the deposit of earthy salts, and we find this in excess along the concavity of the arch of bent bone. In some instances the deposition is excessive, and the bones are rendered more massive than natural. This state has been termed "Hyperostosis." There is related in the 'Philosophical Transactions,' 1740-1, the case of a man who had been so ricketty in his youth, that almost every bone was distorted. At eighteen, he began to grow stiff, but he survived till sixty-one. At his death, the skeleton was found to be one continuous bone. One of the earliest symptoms of the disease is swelling of the articular extremities of the bones; the shaft of the bone is soft, the periosteum thickened, and a microscopic section of the bone shows the lacunæ larger than natural. The bones are very liable to fractures, but such accidents commonly are repaired in the usual time.

When rickets continues beyond the seventh or eighth year, the changes are such as to condemn the child to a life of infirmity. The deformity of spine and chest affects the position of the thoracic viscera, the heart beats quickly, the respiration is hurried and panting; the stomach may be pushed downwards. The patient commonly dies before middle life of bronchitis, pneumonia, tubercular disease, or dropsy. Peculiar nervous symptoms have been noticed, such as temporary deafness or blindness, irritation of the bladder, inability to expel the urine, deafness, &c.

Treatment.—During the existence of rickets the surgeon has to remove a state of general febrile excitement, which interferes with and nearly arrests healthy nutrition. Hence we administer very small doses of antimonials, hyd. c. creta, magnes. and rhubarb, to act gently on the bowels; or rhubarb and soda, castor oil, senna. The child should be weaned, and supplied with good cow's milk. In the second stage, sea-bathing, tonics, quinine, gentian, are the measures usually found most serviceable; oxide of zinc, carbonate of iron, cod-liver oil, have also been recommended. In some constitutions the alkalies seem preferred; carbonate of soda when the bowels are relaxed; carbonate of ammonia when the heart's action requires it. The clothing should be warm, and protect both knees and elbows. The use of splints and apparatus is a subject of paramount importance, the object being to *prevent* alteration in the shape of the bones. If the child pass through this period of infantile suffering without great deformity, the recovery is complete. If the bones bend, the deformity is permanent. Rest in the horizontal position is also very important during some part of the day. For the method of applying splints I must refer to the chapter on knock-knees and bow-legs.

Closely allied to rickets in the young is the "mollities ossium" of adults (malacosteon). Fortunately it is a disease of very rare occurrence; its pathology is still imperfectly understood. Thus much we know, that the term was loosely employed by the earlier writers, some of whom made no difference between "fragilitas ossium," which is generally a condition of executive atrophy of bone, by which the shaft is reduced to a thin shell containing a quantity of semifluid marrow, and mollities ossium, in which the bone lacunæ are enlarged as in rickets, are filled with the same reddish material, and in which there is a general deficiency of the earthy matter.

This disease is more common in females than in males, and by some it is supposed to be hereditary. Its advent is generally ushered in by pain, and its progress has been remarkably rapid. The cases of deformity of the female pelvis, by which parturition in the natural way is rendered impossible, is due either to very severe rickets during infancy, or to this disease of later life, mollities ossium, which has been observed most frequently in women who have borne children rapidly.

In the Museum of St. Bartholomew's Hospital (Ser. I. A 167) there is the pelvis of a woman on whom the cæsarian operation was performed. She was thirty-two years of age; formerly five feet one and a half inches, latterly four feet two and three-quarter inches in height. She had given birth without difficulty to three living children at the full term of entire gestation. She suffered from symptoms closely simulating those of rheumatism for two years before her death. The flat bones, especially the scapulæ and ossa innominata were implicated in the disease, not the long bones. For some time the urine contained a large amount of the triple phosphates. She died three weeks after the operation.

No. 164 A is a similar specimen. The pelvis and femora of a woman on whom the cæsarian operation was performed. The case is fully described in the 'Lancet,' February 6, 1847.

Instances have been recorded in which it has developed itself at advanced age.

Microscopic examination of bones thus affected shows a conversion of the osseous substance into connective or into fibrous tissue, the bones into a brownish red, hæmorrhagic fat, in which are found granular cells and amyloid bodies The disease attacks especially the bones of the trunk, where it may confine itself to a single part. It has been associated with cancer of internal organs (Rokitansky).

The same disease has been described by Messrs. Varnell and Harley as occurring in the horse.*

One of the most complete and instructive cases is that described by Dr. William Macintyre, in the XXXIII. vol. of the 'Transactions of the Medical and Chirurgical Society.' The patient, aged forty-five, a tradesman in respectable circumstances, was confined to the house October 30, 1845, by excruciating pains of the chest, back, and loins, from which he had been suffering more or less for upwards of twelve months. The only positive information gained by the examination of the thorax was that the heart was not in a satisfactory state. The urine was opaque, acid, and of high density, the specific gravity being 1035°, but it gave no indication of the presence of sugar to Trômer's, or to Moore and Palmer's tests. It abounded in animal matter, exhibiting all the characters of albumen. With nitric acid, however, this urine displayed anomalies of a remarkable kind. On the addition of the acid, no immediate precipitation took place; on the contrary, the urine, previously cloudy or turbid, became instantly clear and retained its transparency for an hour or an hour and a half, when it was found to have formed into a firm yellow mass, which, unlike the coagulum resulting from the action of nitric acid on serum sanguinis or ordinary albuminous urine, underwent complete solution on the application of heat, but again consolidated on cooling. When, however, the urine was previously heated to ebullition, and, while still fluid, was allowed to cool down a few points, the coagulum was almost instantly obtained, and like that resulting from the slow operation in the cold, suffered redissolution on the temperature being raised to the boiling point. Oxalic acid threw down a copious white precipitate. Tannin and tincture of galls turned the whole into a tough mass.

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* "A peculiar and unusual disease of the osseous tissue in the horse, resembling, in many of its characters, mollities ossium, osteoporosis, and fatty degeneration of bone;" reprinted from 'Veterinarian,' 1860; by G. Varnell, M.R.C.V.S. Dr. Harley, on the same disease, 'Trans. Path. Soc.,' p. 308.

Under the use of the neutral salts, the urine became more abundant, and deposited a copious sediment of the triple phosphates. Some time after the urine presented an altered appearance, being turbid and thick, like pea-soup. The phosphates had given way to an enormous quantity of the lithates, which owing to the great density of the urine (1040°), remained for hours suspended. Finally he died exhausted.

The *post mortem* examination, most carefully recorded, threw no light on the pathology of the disease. But Dr. Macintyre very rightly calls attention "that the juvantia and the lædentia correspond very closely with the experience of preceding observers." Whatever amount of improvement was at any time remarked, took place under invigorating therapeutic measures, whilst an aggravation of suffering invariably followed depressing remedies or exhausting influences. Twice was the disease seen to take a start after the loss of blood; and on the second occasion its career was arrested in a remarkable manner by a powerful tonic. These facts are not without practical application, and the remark of Mr. Curling is not to be disregarded, viz., that we should bear this disease in mind when treating pains of the limbs of an obscure and intractable character.

In a case related by Mr. Solly, the urine was greatly in excess, although earthy matter was not present as a sediment. On dissection, phosphate of lime was found clogging up the calices and pelvis of the kidney, forming there a solid calculus.

"All the circumstances of these cases," observes Mr. Curling, "would seem to indicate that the blood was loaded with something which it was glad to get rid of by any of its natural outlets." The enormous quantity of animal matter was probably albumen in some peculiar state of combination or condition, and in the opinion of the late Dr. Prout, was probably "the material which, if the kidney had done its duty, would have been converted into lithate of ammonia."

I will in the next place say a few words on simple *Weakness of the Bones*, such as we see in young growing children, whose legs are not strong enough to sustain the weight of the body. This is a very common affection among all classes, and especially the poor. There is no swelling of the ends of the bone; the affection is in no way allied to rickets; the bones are simply weak, and they bend in that part which is weakest. Combined with this weakness of the bones there is often found a corresponding weakness of the ligaments. Thus a young child may have knock-knees, and anterior and outward curvature of the tibiæ. Or, on the other hand, the tibia may curve outwards, producing bow-legs. Or again, there may be knock-knee on one side and bow-leg on the other. If the condition of knock-knee is severe, and has been of long continuance, it produces a sinking of the arch of the foot, technically termed talipes valgus; and under all these circumstances progression is painful, uncertain, and difficult.

If the curvature be allowed to go on unchecked, it produces very serious deformity, which is irremediable in the adult without the constant employment of instruments. In the young child the management is very easy.

I saw a young lady, aged eighteen, in June, 1862, whose legs had been allowed during infancy to become "bowed." The deformity was not considerable, but it gave rise to much annoyance. In the first place, her gait was not so firm and steady as it should have been. Secondly, she wore out all her shoes on the outside edge. Thirdly, the legs being not quite equally bowed, their length did not completely correspond, and a compensating curvature of the spine was the result. The parents thought

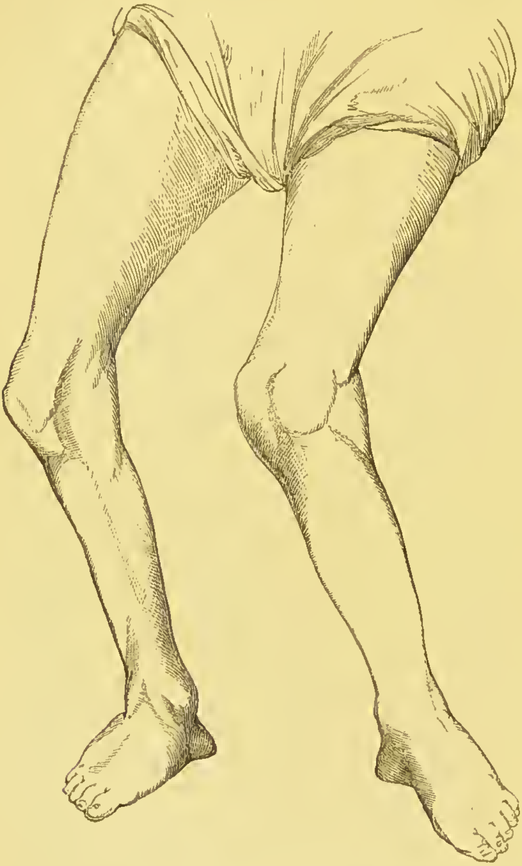

Fig. 25.—Genu Valgum and Genu Extrorsum.

that the deformity was on the increase. Now the bones were too firm at the age of eighteen readily to yield to the pressure of a splint; the treatment should have been adopted at a much earlier age. I represented that as these changes in figure were but slight, no mechanical support was immediately indicated, but that some such measure would become imperatively necessary should the curvature increase. Long walks or constant standing was forbidden; but she was directed to ride on horseback, and pursue such habits as were calculated to improve the general health.

In cases of confirmed knock-knee, the gait is equally uncertain and ungainly. Any one may detect the deformity, even in the female, at once, by the way in which she rolls about in progression.

In May of the present year, a respectable woman brought to me a child about three-and-a-half years of age, who was suffering from knock-knee, and curvature of the tibiæ, increasing in degree until the little girl could scarcely stand. She had been to a large hospital, and was there told that "splints were of no use, the child must remain as it was." It is scarcely necessary to add that long outside splints were applied, and that complete recovery ensued after a period of eight months.

Fear on the part of the parents that the bandages and pressure will make the limbs shrink, is without foundation. Fatty degeneration of a limb, or part of a limb, follows the loss of power along the course of nerves, but is not associated with simple pressure.

Treatment of Genu Valgum, or Knock-knee; Genu Extrorsum; Genu Valgum, with Genu Extrorsum of the Opposite Limb; Genu Valgum, and Curvature from Rickets and other causes.—Genu valgum is one of the most common of deformities in children. A fine, large infant, generally of fair complexion and auburn hair, has a body too heavy for the legs. It commences to walk early, and the internal lateral ligaments of the knee-joint yield. The knees rub against one another in walking, the child's gait becomes unsteady, and a careful examination detects the existence of the affection. Let the child lie down flat on its back, and the surgeon, taking hold of the ankles, finds that in the extended position of the limbs the knee-joint is too loose, and that the ankles can be more or less widely separated from one another.

Let me advise the surgeon to abstain from blaming parents or nurses for inattention in these cases. There may be great excuse for persons unaccustomed to the study of medicine and the treatment of disease; but what shall we say to those who, themselves educated, refuse to admit the principles of orthopœdic treatment in cases so simple and so easily managed.

A lady, some months ago, requested me to see her child, a fine little girl of three years of age, who was the subject of double genu valgum. She had been told that the child would "grow out of it," that splints would make the legs wither; that splints once worn must be never laid aside. The deformity, however, increasing, she applied to me. Now in this case, the child was nearly cured in six months by the steady application of outside splints; and in the course of a few months more she will be able to dispense with all artificial support.

If we are consulted concerning the legs of a very young child, the subject of genu valgum, and can ascertain that there is any disturbance of the general health, we may be content with directing removal, if possible, to sea air, with the administration of small doses of steel medicine, and instructions that the little patient should recline as much as possible when indoors.

But if the deformity be well-marked, the greatest advantage is to be obtained from the use of wooden splints. These splints should be of flat wood, two to three inches wide, and extend from below the ankle to above the waist, where they must be perforated to allow the passage of a webbing strap behind the body. Unless this webbing strap is properly applied, the upper extremity of the splint slips forward, and the support as regards the limb is lost. I trust that these directions will not be considered superfluous. If they are neglected, the treatment will be abortive.

Next how to apply the splints. The patient must be in great part undressed. A roller is carefully applied from the foot, which is covered, to above the knee, to prevent œdema. The stocking and boot may then be put on. The splints are applied to the outer side of the limbs, extending from the ankles to the waist, and fixed by means of webbing straps and buckles, which admit of being tightened, as occasion requires, that the pressure may be equal and unremitting. Then the strap is to be fixed *behind* the waist.

I have seen these cases under supposed treatment with a splint extending half way up the thigh, and loosely attached by a calico roller: such a measure is simply useless. The calico yields, so as to cease to press; the splint, being too short, twists, and becomes oblique precisely where it should be kept parallel with the limb.

In severer cases, the splint may be made of two portions, one for the thigh, the other for the leg, united by means of a hinge worked with a cog-wheel. Straps of the same unyielding material pass round the limb.

The division of the tendon of the biceps flexor cruris is necessary only in severer cases. The operation may be performed as follows:—Let the patient lie on his face, while an assistant puts one hand under the thigh, just above the knee; while with the other he grasps the ankle. If the patient be then told to press the heel against the assistant's hand, the tendon of the biceps will spring up and be readily felt and distinguished from any other structure. Introduce a sharp-pointed knife close to the tendon, on its popliteal side; turn the edge outwards, and the biceps tendon is readily divided. The division of the peroneal nerve is an accident which sometimes happens. The pain and the subsequent paralysis are alarming; but after a time the foot will regain its sensibility, the nerve uniting without difficulty. This accident happened to the late Mr. Lonsdale, and to others; but the inconvenience has been temporary.

But the external lateral ligaments of the knee may yield without deformity of the bones. A stoutly-made gentleman, about sixty years of age, applied to me in consequence of outward bending of his legs at the knee-joint. The bones were straight, the yielding was solely at the ligaments of the knee, caused, as he rightly supposed, by his increasing weight and inability to take exercise. I directed the use of an apparatus consisting of inside irons, with leather straps, and joint with cog-wheel at the knee. In the course of a few weeks the patient found that the increasing deformity was arrested, that the bones of the lower extremity were in better apposition, and that finally he was enabled to walk down to his office with the aid of a stick, a feat which he had supposed he should never perform again.

It is remarkable that in these cases the articular surfaces of the tibia and femur undergo but little change in shape.

The employment of outside supports must be continued in adults long after the limbs are put straight. A pelvic band and outside irons attached to the boot is the most commodious. Some support must be worn night as well as day, until the patient can stand and walk without the joints yielding.

Let it be remembered that in females, owing to the width of the pelvis, there is always some amount of knock-knee, which is natural.

Outward inclination of the knees, genu extrorsum, is very common in ricketty children. In these cases, we generally find the tibiæ curved outwardly. And this deformity is regarded as one of the bones of the leg. The femur is usually but little curved, and it separates from its fellow, that it may adapt itself to the surface of the tibiæ. This is "bow-legs" and the treatment consists in the application of inside splints, extending from the ankle to above the knee. When we have succeeded in putting the bones of the leg straight, the deformity in great measure disappears.

In very many young children, we meet with cases of anterior and outward curvature of the tibiæ, sometimes combined with knock-knee. Many of such patients are rachitic; others are not so: the mechanical treatment is the same. In cases of genu valgum, we still use the outside splints. When the anterior and outward curvature of the tibiæ is strongly pronounced, we use the short inside splints. In severer cases we may use the two combined, and with every prospect of success, provided the pressure be maintained equally. Bones are elastic, and yield to steady continuous pressure. Thus the majority of the cases do well in the young, provided only we can set right any constitutional errors, and give the patient the benefit of fair health.

In some rarer cases there is genu valgum of one leg, and genu extrorsum of the other. Such a case requires a long outside splint in the former, and a shorter inside splint in the latter. A woodcut representing the deformity is given in page 278.

CHAPTER XV.

ON THE TREATMENT OF CICATRICES AFTER BURNS.

SURGEONS formerly believed that contractions following the cicatrisation of burns were due to the subsequent absorption of the granulations on which the new skin is formed, a process by which the magnitude of the scar is afterwards lessened. But it will be perhaps juster to explain this process upon the supposition of the development of a contractile material in the newly-formed scar, equally capable of normal growth, of hypertrophy, or of absorption. The existence of this material is evident to the touch: it constitutes those hard and prominent bands which start from the injured neck, and strap down the everted lip to the chest, dragging on and distorting both jaw and features. It is this firm and unyielding tissue which holds the contracted arm or leg, and binds the fingers to the palm of the hand, &c. The enormous power which it seems to possess, and to exercise surely though slowly, is well known; although perhaps there are two points respecting its pathology to which sufficient attention is not usually paid—first, the length of time, amounting to many years, during which the contraction, with its corresponding increase of deformity, will go on; secondly, the facility with which, by slow and gentle yet powerful extension, the contraction may be overcome without surgical operation, and the peculiar contractile material become entirely absorbed.

Most surgeons, having the advantage of considerable hospital experience, believe that the simple division of these contractions fails altogether, or only produces very partial and temporary relief, as, after the cicatrisation is completed, "the newly-formed parts are absorbed, and the contraction recurs." The proposal of the late Mr. Earle, to cut away the entire cicatrix, and then to bring the edges of the skin as much towards each other as possible in the transverse direction with strips of adhesive-plaster, is an operation painful in the execution, of very limited applicability, and of very doubtful result. A case, in which the operation is quoted as successful, namely, in the arm of a growing child, aged six, was obviously unsuited for the proceeding, as the desired end could have been obtained by much safer and simpler means. The operation suggested and performed by Mr. Teale, of dissecting away and moving bodily with the cicatrix a considerable portion of the adjacent uninjured integument, is again a serious measure, although the results are reported as satisfactory. Wherever the knife goes, a new cicatrix, with its necessary condition of subsequent contraction, *must* form; and there are the usual contingencies in connection with the performance of a plastic operation. A step in the right direction was made by Mr. Skey, who, seeing the evils inseparably connected with large wounds and tedious cicatrisation, recommended the plan of small incisions, each of which would form, in extension, a limited surface easily closed by the usual healing process from the circumference towards the centre.

The subcutaneous division of firm and unyielding bands is recommended, in exceptional cases, by other surgeons; and instances occur in which both of the latter proceedings are applicable. But my present object is to state that most cases of contraction from burn admit of relief by a simple process of graduated extension, without any incision whatever.

George Bewall, æt. eight, was sent to me from the country that he might be admitted into St. Bartholomew's Hospital, April 7, 1859. The appearance of the child was certainly hideous: the lower lip was everted and bound down by firm cords to the upper part of the chest; the mouth was generally open; the front teeth were acquiring a horizontal direction; saliva and mucus constantly dribbled away; the articulation was imperfect, and mastication difficult. The features were dragged downwards, and to one side, the left lower eyelid becoming gradually everted. The bands of the cicatrix were numerous and hard, one of them being, at the central part, detached from the subjacent structure, so that a probe could pass beneath it. The amount of deformity was as great as I have ever seen in the usual cases of severe burns of the neck. May 10.—An apparatus, constructed by Mr. Fergusson, of Giltspur Street, was applied. It consisted of a pelvic band, with double crutches to steady the instrument. A steel support extended posteriorly from the pelvic band to the neck, where two pieces of padded steel passed round to the symphysis of the jaw. The upper part of the apparatus was movable by cog-wheels, either upwards or downwards, the padded support to the jaw admitting of accurate adjustment.

It is unnecessary for me to give a daily report of the case. The boy has never had any pain, but has been playing about the ward, during the whole period of treatment. At the present time, Nov. 20, the mouth is closed, and there is no further dribbling of saliva. His features have lost their drawn expression ; he can eat and speak as other children ; and is changed from an ugly-looking object to rather a pleasing lad. But the most remarkable pathological change is in the cicatrix. Not only is it greatly elongated, but the firm thick bands have entirely disappeared. The skin is quite loose and soft, and bears a very considerable resemblance to normal integument. I have had very many such cases.

Experience has shown, that after extension of the integument constituting the cicatrix, the absorption of the contracting material is a permanent and not a temporary change. The patient remains free from the dangers attending relapse ; and there is even a chance, with care, of further improvement. In the case of the neck, a silk handkerchief or a collar contributes to the concealment of the deformity, and the patient passes through life free from the consciousness that he is an object of aversion to his fellow creatures.

CHAPTER XVI.

ON THE TREATMENT OF CONTRACTED TOES AND CORNS.

CONTRACTION of the toes mostly proceeds from the habit of wearing boots which are too narrow or too short. When the boot is too pointed, the great toe may be pushed diagonally across the others, a corn or bunion forming at the metatarso-phalangeal articulation. Among patients in the upper class such a form of boot commonly brings together the extremities of the great and the third toe when the second becomes contracted towards the sole, the first joint forming a projecting angle which rubs against the upper-leather of the boot, and is rendered excessively sore. So distressing is this state of the foot to patients, especially when young and active, that they would be quite willing to submit to amputation of the offending member. In other cases the second toe is completely covered by the other two, when pain is experienced by the irregular pressure on the sole.

Whenever the great toe deviates from its normal direction, the tendons of both flexors and extensors undergo a corresponding change. Pain ensues from irregular or spasmodic action, and the patient becomes easily tired. Chronic inflammation may ensue from the practice of wearing badly-made boots, when all the toes will become contracted, and progression will be painful.

The contraction of the great toe from gouty or rheumatic disease of the metatarso-phalangeal articulation is usually too painful an affection to admit of surgical treatment.

In all cases the patient must be directed to procure boots which are sufficiently long, and square towards the end, and with a breadth of sole equal to that of the foot. No other form of boot will answer. Sufficient space is required for the free play of all the parts. The subcutaneous division of the tendons may be necessary —mostly that of the long flexor, beneath the first phalanx. When the wound is healed the toe should be strapped down on a piece of wood. I have had various forms of springs made to drag the adducted or abducted toes into the straight line; and, in some instances, a boot with partitions between the toes, so as to prevent friction and preserve the proper relations.

The treatment of corns would, generally speaking, be easy were patients to wear properly-made boots. This thickened state of the cuticle, constituting "a corn," cannot occur when the pressure is even and moderate. Two conditions are indispensably necessary for comfort: first, sufficient width of sole; secondly, sufficient squareness "of the toes." To these may be added ample space under the upper-leather. Boots, as usually worn by ladies, have the sole from half an inch to an inch too narrow; hence, in walking, the sides of the foot bulge over the border, and are pressed upon accordingly. Men's boots are often subject to the same faults, beside being narrowed, so that the toes are gathered together and the direction of their tendons becomes altered: muscular movements are consequently painful. It is strange that people should subject themselves to the miseries which the presence of corns will entail! I have had more trouble in convincing a patient that he or she had for years been wearing over-tight boots than in conquering the opinions of others on more serious matters.

The first step in the treatment of corns consists in removing badly-made boots, and providing others in which the foot has proper play. For the removal of the hardened cuticle the recipes are endless. One of the best, under the surgeon's care, is equal parts of caustic lime and potassa fusa made into paste with a little spirit. A small quantity applied with lint to the corn destroys the cuticle rapidly. Others use nitric acid: the use of the knife is not safe in the hands of aged persons.

Corns on the soles of the feet mostly depend on contraction of the tendo Achillis. This condition, which holds the foot immovably fixed at right angles, prevents the slight elevation of the member towards the front of the leg, which is the first act of the "step forward." The foot is held at the right angle, and consequently the front of the sole is pressed with undue force on the ground, and the toes catch in any irregularity of surface. Finally, a corn forms, which causes the patient great discomfort: suppuration may take place under it, when the pain becomes insupportable. The only permanent remedy is the subcutaneous division of the tendo Achillis, its elongation, and the restoration of the foot to its normal sphere of action.

Corns which form between the toes disappear when the boots are sufficiently square to allow free play to these digits. Pressure may be taken off by means of a long strip of adhesive-plaster wound many times round the corn, and kept there for weeks, subject to proper renewal. After a time the corn separates, and comes away with the plaster.

When the proper form of the foot has been restored, and the patient uses well-made boots, corns and other local annoyances disappear, and a fair amount of exercise can be taken without discomfort.

Among the subjects brought to St. Bartholomew's Hospital, in the winter of 1857, there was one in whom all the toes were in a state of permanent extension. We found the extensor muscles of natural appearance and colour; but the flexor muscles were pale and much wasted. The flexor longus pollicis was almost completely degenerated into fatty tissue, the fibrous structure being just visible. The tendons were unaltered.

CHAPTER XVII.

ON MALIGNANT DISEASES.

Malignant diseases involving joints are usually described in works on "diseases of bones," inasmuch as the structures peculiar to joints possess a remarkable immunity from the invasion of such affections. A cancerous tumour of the head of one of the long bones may acquire a great size, and encroach upon a joint to its complete destruction, without producing the usual symptoms of joint-disease. Thus (Ser. II., No. 116, Museum of St. Bartholomew's Hospital), a tumour, taken from a man aged forty, whose limb was removed by amputation, was found to occupy the situation of the head and the upper third of the shaft of the tibia: it apparently originated in the interior of the bone, and extended the wall around it as it grew. At the upper part, the articular surfaces of the tibia and the ligamentum patellæ were just to be recognised. The tumour consisted of white, solid, and very firm medullary substance, and in part of a more vascular and spongy substance, in which were large cells that were filled by a gelatinous fluid. In the same series (No. 46) a brain-like medullary tumour, which has grown within the condyles of the femur, has extended them into a large thin-walled fibrous and osseous cyst. The tumour projected chiefly backwards and laterally, part being covered by the articular cartilage of the femur: in the middle and between the condyles it perforated the cartilage, and penetrated into the knee-joint in front of the crucial ligaments.

The comparative frequency of malignant disease in the lower extremity, as contrasted with the upper, has long been a matter of clinical observation; and has been supposed to furnish an argument in favour of the origin of such diseases from local injury, the long bones of the lower extremity being so much exposed to shock and other accidents. In confirmation of the evidence afforded on the subject by pathological collections, is the careful and laborious work of Dr. Gurlt.* He notices the occurrence of cancer in the bones of the spine, the wrist, the hip, the knee, and the ankle; and omits notice of it wholly, or nearly so, in other situations. Mr. Cæsar Hawkins has recorded the particulars of a case of cancer of the cervical vertebræ.† The patient; a man seventy-four years of age, suffered from a firm swelling, which occupied the situation of the third and of part of the second cervical vertebræ. The morbid growth included the greater part of the arch and also of the body of the vertebræ, so that only the odontoid process remained free, and was so movable that it was fractured during life. Part of the tumour had made its way into the spinal canal, and was situated between the dura mater and the first and fourth vertebræ. The tumour was white and lardaceous. The brain and spinal chord were sound. Bühler relates a case of cancer affecting the bodies of the greater part of the vertebræ,* and I have seen such a case in private practice attended with angular curvature of the spine.

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* 'Beiträge zur pathol. Anat. der Gelenkkrankheiten,' 1853.

† Cæsar Hawkins, 'Med. Chir. Trans.,' 1841.

Of all situations the knee is, I think, the most frequent seat, whether the disease originate in the lower end of the femur or the head of the tibia. In the Museum of the College of Surgeons of England (No. 850) there is a specimen of cancer of the patella, which seems to have become the seat of a medullary-cystic tumour, consisting of brain-like substance and cells surrounded by fibrous tissue. The tibia and femur appear sound. This is, however, extremely rare. In the ankle-joint cancer is comparatively uncommon. There is one specimen in the Museum of the Hospital (Ser. I., No. 159-160). It consists of an encephaloid tumour, with clots of blood, in the lower end of the tibia. It is almost completely surrounded by a thick bony cyst; but the articular cartilage is completely covered by white medullary matter.

The great majority of instances of cancerous tumours of joints are of the encephaloid variety ; fibrous cancer is rare, and both these morbid products, developed within the bones, seem to be more limited and less likely to involve the absorbent glands, so as to be combined with cancerous tumours of internal organs, than in cases of similar diseases originating in softer structures. The occurrence of inflammatory symptoms in the proper structures of a joint would indicate a very advanced state of the cancerous disease.

Osteoid tumours do not readily affect the interior of a joint ; when they interfere with the movements of an articulation, the cause proceeds from the development of osseous bands or growths passing from bone to bone. Mr. Hamilton Lebatt mentions the particulars of such a tumour,* which extended from the iliac fossa over the thigh, and thus caused immobility of the hip, the joint itself being healthy. In the knee-joint specimens are more common.

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* Bühler, 'Krebs der Wirbelsäule.' Zurich, 1846.

I have never met with a case of melanosis of bone except as a secondary disease, the original tumour having appeared either in the eye or the skin, or in some situation where pigment is normally found.

Euchondroma is strictly a disease of "bone."

Tumours consisting of acephalocyst hydatids have been found affecting joints; but then only as a secondary disease,—that is to say, the joint has become involved after the tumour had attained a considerable magnitude. Cases have been observed in the shoulder, elbow, hip, and knee; also in the vertebræ. Of the latter a case has been recorded by Mr. Dixon.†

Cases of cancer and of anomalous tumours affecting joints require, in most instances, the removal of the limb. The surgeon's own judgment and experience must guide him both as to the time and the method of performing such an operation. The rule is, however, absolute, that, when possible, it is best to remove the entire bone which is affected.

In cases of cartilaginous and fibro-cartilaginous tumours, the same necessity does not exist.

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* 'London Med. Gazette,' New Series, vol. ii., 1838.

† 'Med. Chir. Trans.,' vol. xxxiv., 1851.

INDEX.

A.

Abscess, in tibia, 38; in femur, 39; knee, 141; in neck, 156; muscle, 187.
Adams, R., 125.
Angular curvature, 152.
Absorption of pus, 14.
Ankle-joint, 144.
Articular cartilage, disease of, 43, 49.
Apparatus, 85, 123, 159, 247.
Atrophy, of head of femur, 116; of muscles, 186.
Astragalus, fracture of, 150.

B.

Blood, abstraction of, 20, 24, 61.
Brodie, Sir B., 25.
Barwell, 25.
Bonnet on synovitis, 27.
Bow-legs, case of, 28.
Bones, articular extremities of, 36.
Baths, use of, 73.
Biceps tendon, 98.
Bursæ mucosæ, 222.

C.

Classification of joint-diseases, 3, 4, 6.
Callender, Mr., on pyæmia, 16.
Chambers, King, Dr., on rheumatic disease, 23.
Contractions of limbs, 201.
Coulson, Mr., case by, 25.
Chronic rheumatism. 34.
Cartilage: hypertrophy, 41; atrophy, 43; ulceration of, 47 , fibrous degeneration, 49; ossification, 50; loose. in joints, 51.
Cicatrices after burns, 285.
Club-hand, 111.
Colles, 125.
Caries of spine, 152.
Cold, use of, 76.
Corns, 288.
Curvature, lateral, 168.

D.

Dislocation from rheumatic disease, 28; accident, 81.
Displacements of patella, 143.
Diet, 173.
Dislocation at the knee, 189.
Delusions, hysterical, 191.

E.

Embolism of arteries, 17.
Epiphysis, separation of, 43.
Extension of joints, 68; forcible, 82; fingers, 113; knee, 130.
Elbow, 99; accidents at, 103.
Excision of knee, 140.
Effects of sprains, 211.
——— of wounds, 219.

F.

Fibrous degeneration of cartilage, 49.
Fracture of humerus, 99.
Fingers, contraction of, 113.
Forcible extension, 134.
Foot, diseases of, 145.
Fracture of astragalus, 146.
Fibrous tumour in tendon, 188.

G.

Genu valgum, 277; extrorsum, 278, 283.

H.

Hydrops articuli, 26.
Hip, 116.
Hypertrophy of muscles of the calf, 143.
Hysteria, of spine, 165; of joints, 191.
Hand, spasmodic closure of, 195.
Hereditary malformations, 241.

I.

Inflammation: synovial membrane, 9; of ankle-joint, 147; of spinal column, 161.
Injuries to joints, 215.
Inflammation after wounds, 215.

K.

Knock-knee, 27.
Knee, diseases of, 127; excision of, 138; dislocation of, 189.

M.

Muscles of the calf; hypertrophy, 143.
Maxilla, disease of, 152.
Muscles, diseases of, 185; atrophy, 186; fatty degeneration, 186.
Malignant disease in muscles, 187.
Melon-seed shaped bodies, 225.
Malformations, hereditary, 241.
Mollities ossium, 273.
Malignant diseases, 293.

N.

Nerves, effects of, on nutrition, 2, 3.
————————, on position of diseased limb, 19.
Narcotics, 64, 65.
Nutrition, 1.
Necrosis, of femur, 40; diffused, 41.
Neck, wry, 202.

O.

Os calcis, 145.
Olecranon, bursa over the, 234.

P.

Pain in disease, 49.
Patella, displacement of, 143.
Pathology, general, 8.
Punctured joint, 11.
Pus, in joints, 12.
Pyæmia, 15, 24.
Pressure, effects of, 56.
Paget, Mr., on anchylosis of cervical vertebræ, 155.
Patella, bursa over, 234.

R.

Richet, experiments of, 10.
Rheumatism, 22, 46.
Resections, 6.
Rest, treatment by, 55.
Rickets, 269.

S.

Statistics of joint-diseases, 5, 36.
Semilunar cartilage, 140.
Spasmodic closure of hand, 195.
———— cases, 197.
Synovitis, 8, 18, 21.
Synovial membrane, peculiar changes in, 33.
Splints, 55.
Shoulder, 91; bursæ about, 231.
Smith, W., 125.
Spine, caries of, 155.
Spinal curvature, congenital, 181.
Suppuration in muscle, 187.
Sprains, 207; treatment, 209.

T.

Treatment: synovitis, 19, 29; of joint-diseases, 54; rest, 54; pressure, 55; of spinal disease, 175; of rickets, 272.
Talipes equinus, 248.
——— equino-varus, 256.
——— calcaneus, 257.
——— varus, 258.
——— valgus, 265.
Tendons, division of, 67; diseases of, 185.
————, rheumatic inflammation, 181.
Treatment of sprains, 209.
———— of diseased bursæ, 234.
Talipes, 239.
Tendon, examination of divided, 244.

V.

Vertebral column, 152.
Volkmann's views on pus in joints, 13.
Vertebral column, angular curvature, 157; lateral curvature, 168.
Vertebræ, deformed, 170.

W.

Wasting of muscle, 3.
Wrist, 108; bursæ about, 232.
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Weakness of bones, 277.
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INDEX

To the Works published by Robert Hardwicke.

Accidents, First Help in .... *Page* 22
Air and Water 6
Algæ, British, Handbook of 11
Anæsthesia with Mixed Vapours 10
Animals, Uses of 16
Aortic Valves, Insufficiency of, in sudden Death 6
Arcus Senilis 5
Arithmetic, Elements of 4
Asthma, Consumption, Bronchitis, Treatment of 19
Astronomical Observer 8
Australia for Consumptive 5

Bathing, How to do it, &c 23
Baths, Roman 28
Ben Rhyding, Handy Guide to 26
Bibliographia Zoologiæ et Geologiæ 1
Bone, Cancerous Disease of 13
Bones (Old), or Notes for Young Naturalists 26
Botanic Terms, Manual of 7
Botanical Works of Robert Brown 5
Botany (British and Foreign), Journal of 23, 30
Botany (English), Sowerby's 25
Botany, Manual of Structural 7
Botany, Reports and Papers on 22
Botany (Scientific), Principles of 16, 22
Brain and Mind, Diseases and Disorders of 28
Brain, The Human 25
British Association Report, 1865 4

Carbolic Acid as a Disinfectant 6
Cattle Plague, by Gamgee 11
Charities, Royal Guide to London 11
Chemistry, Brande and Taylor 3
Chest, on Penetrating Wounds of 11
Childhood, Diet of 2
Children, Hygienic Treatment of 2
Cholera (epidemic) and Diarrhœa 11
Cholera Prospects 10
Cirripedia, Monograph of 8
Civilization, Curiosities of 29
Clinical Medicine, Lectures on 2
Clubfoot, Cure of 2
College of Surgeons, Reports of 6
Consumption, Prevention of 13
Consumption, Treatment of 7
Cosmetic Arts and Toilet 5
Consumptive, Australia for 5
Country Cottages 27
County Families 27
Crustacea, British Entomostracous 2
Cryptogamia (Higher), Developement of 13

Darwin's Origin of Species, Huxley's Lectures on 14
Dental Review 30
Diabetes 24
Disinfection, Prevention of Disease 6
Dog (British), History of 14
Domestic Medicines, their Uses and Doses 8
Drawing, Inventive 2
Dropsy and Diseases of Kidney 11
Dropsy, Ovarian .... *Page* 4
Dublin Quarterly Journal of Medical Science 30

Earth, True Figure of the 12
Electricity, Atmospheric 20
Elementary Books, Hardwicke's 12
Enshrined Hearts 13
Entozoa, Catalogue of, in Museum of College of Surgeons 6
Entozoa, Human 24
Epidemics Examined and Explained 11
Epidemiological Society, Transactions of 30
Epilepsy and Paralysis, Curable Forms of 21
Equestrians, Pocket Manual for 27
Essays and Reviews, Their Origin, History, &c 15
Essays and Sketches, Scargill's 22
Eye, Hints on Diagnosis of Diseases of the 6
Eye, Optical Defects of the 17

Farm Cultivation, Science and Practice... 5
Feet, Motions of the Human 9
Ferns, British and Foreign 24
Ferns (British), Plain and Easy Account of 16
Fern Collector's Album 16
Fireplaces, Our Domestic 10
Flooding after Delivery 9
Food, Lectures on 16
Foot, the, and its Covering 9
Foraminifera (Recent), Monograph of ... 28
Foraminifera, Study of 5
Fungi, British 6
Fungi, Microscopic 7
Fungorum Britannicorum Index 7

Garden Plans, Picturesque 23
Gastric Regions and Victualling Department 11
Generations, Alternation of 26
Geography, Manual of 20
Geology applied to Arts and Manufactures 1
Glycerine 24
Graceful Riding 27
Grasses of Great Britain 15

Hay-Fever, Hay-Asthma, Observations on 24
Hemiptera—Heteroptera, British 9
Heraldry founded on Facts 21
Hoarseness and Loss of Voice, Treatment of 18
Holiday Papers 15
Home Nurse 17
Horse Warranty 14
Humboldt, Alexander von 23
Hydrozoa, Oceanic 14
Hygiène, Personal Notes on 20

Infants and Children, Domestic Management of 2
Infants, Teething of 12
Inhalation for Local Treatment 3
Insects, our Common 8
Iron, Manual of Medicinal Preparation of 9

Joints, Diseases of .... *Page* 2
Journal of Botany, British and Foreign 23, 30

Kent, Corner of 21
Kidney, Diseases of, and Dropsy 11

Laryngoscope (The), Its Use and Value in Diseases of Throat and Nose 14
Laryngoscope (The), Use of in Diseases of Throat 17
Lichens (British Angiocarpous), Monograph of 17
Life on our Globe, Stream of 20
London, Shilling Handybook of 12
Lupus, Treatment of 20

Mackenzie's Educational Books 18
Madras Quarterly Journal of Medical Science 30
Malaria and Miasmata 2
Mangnall's Questions 19
Medical Book-keeping, System of 11
Medical Precepts, plain and practical 10
Medusæ, British naked-eyed pulmograde 10
Metamorphoses of Man and Animals 21
Microscope, Half-hours with 16
Mollusca, British Nudibranchiate 1
Mollusks (British), Land and Freshwater 26
Mounting Microscopic Objects 8
Museum (Local), Notes 17
Museums (Local), Hints on formation of 17

Needlework (Plain), Method for teaching in Schools 5
Nurses and Mothers, Instructions to 19

Ophthalmia, Sympathetic 17
Ophthalmic Review 30
Ophthalmic Surgery 17
Ophthalmoscope (The) 5, 30
Our Social Bees 29
Our Social Bees, New Series 29

Palæontology, or Notes for Young Naturalists 26
Parturition and its Difficulties 8
Parturition without Pain 26
Patents for Inventions 10
Pedigrees, Index to 19
Peerage, Baronetage, Knightage, House of Commons 27
Peter Schlemihl 3
Petroleum and its Products 26
Pharmacopœia (British), Notes on 13
Pharmacopœia, Chemical Processes of ... 6
Photography, Dry Processes in 15
Physio-Philosophy, Elements of 20
Physiology, a Popular Manual of 17
Pike (The), Book of 20
Plants, Geography of 19
Plants, Useful, of Great Britain 15
Popular Science Review 21, 30
Pregnancy, Signs of 9
Primitive World, Ideal Views of 27
Prostitution Medically considered 9
Public Health, Lectures on 19

Railway Travelling, Influence of, on Public Health 15
Ray, John, Letters of 21
Ray, John, Memorials of 21
Rejuvenescence 4
Reptiles of British India 12
Reptiles, Our 7

Rupture, On .... *Page*
Rust, Smut, Mildew, and Mould ....

Scarlatina and its Treatment ....
Science, Fallacies affecting ....
Science Gossip ....
Science (Universal), Seven Essays on ....
Scientia Scientiarum ....
Shooting Simplified ....
Skin Diseases, Comparative Tables of ...
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Sponges, British Fossil ....
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Subtle Brains and Lissom Fingers ....
Surgeons, Coll. of, Reports of ....
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Wild Flowers worth Notice ....
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